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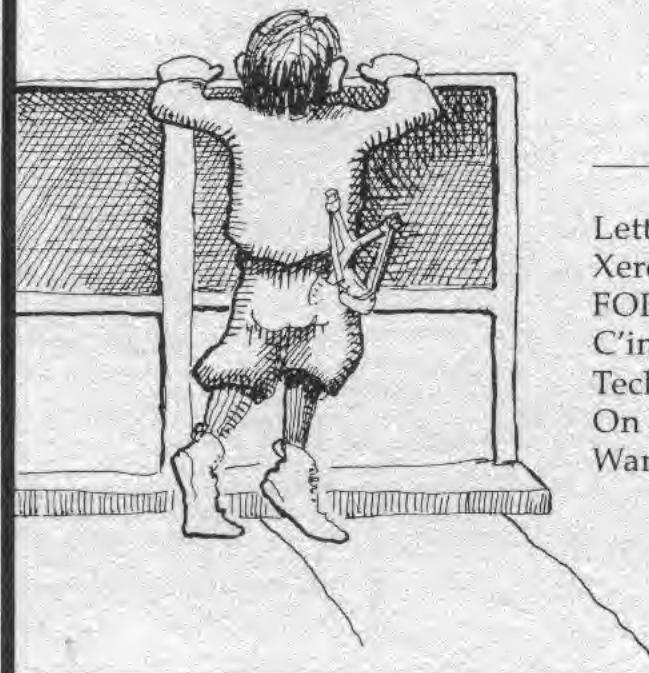


December 1982

No. 9

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\*CP/M is a Digital Research trademark. A 52K CP/M system is required.

## MICRO CORNUCOPIA

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# MICRO CORNUCOPIA

December 1982      The Single Board Systems Journal      No. 9

## We're In

(All In!!)

Moving is no trivial matter unless, of course, you live out of a burlap sack (a bum wrap). But we moved over 10 tons of "necessities" and now have shifted from dump mode (toss it, sell it, or at last resort keep it) to search mode (if we kept it, which box did we put it in).

I've seen those glowing reports about the computer cottage industry. You know, those articles and TV features produced by the NY City jet set describing some mystical group of freaks who don't commute to work every morning—they just live where they want; be it a beach town, a rural farm community, or (like us) in a skiing community nestled against the Cascade Range.

We'll see what it is really like, and in the meantime we'll see if we can't encourage others to join us. (You maybe?)

There's no work here to speak of (the guy who cuts, delivers, and stacks firewood for \$45 per cord is a TV technician when there are TVs to repair), but if you can bring your business with you as we did, then a small community like Bend appears ideal.

The local community college offers very good two-year computer hardware and software programs. That means that there is a pool of technically trained people—both instructors and students. Plus there is an unusually large community of artists, musicians, and other creative sorts who live here because of the quality of life.

I'll keep you all posted on how this grand experiment is working but I may be a little biased by all the friendliness and trust the local people have shown us. (This is the first post office I've visited that accepts out-of-town checks from strangers without asking for any ID.)



### Prices of New Products

After you're involved in computers for a while you get pretty good at predicting what things are going to sell for, and I pride myself with being as astute as the next guy. However I've been delightfully surprised lately.

First, the hard disk interface that Andy Bakkers put together for the Big Board I is definitely one of those surprises. It connects up and works with so little muss and fuss that it is easy to forget you are adding an incredible amount of memory to your system. With five megabytes on drive A, the big board is ready to take its place with heavyweight business systems. When you look at \$240 for the interface (with software!) and \$995 for both the drive and the controller, how can you go wrong.

See the "On Your Own" column in this issue for some thoughts about doing your own trip based on the Big Board (I or II) and 5 or 10 megabytes.

The second delightful surprise has been the power supply sold by BG Micro of Dallas. I did some snooping around on the circuit board after it arrived and I must say, the quality is first class. Everything their ad says is true!

Billy Gage (owner) didn't mention who manufactured the supply but I noticed a small metal tag which read "mfg. by Teletype Corp."

Two of us got these supplies along with the 24V mod kits. We are changing the +12 to +24 and then using the 12V mod from issue #1 (page 4) to reduce a little of the +24 to +12. You can use a 7812 3-terminal regulator in place of the LM317.

We had only two problems with the supplies. First, Billy threw in a couple of special 110V connectors for the supplies (a nice surprise) but he sent male pins for the connectors rather than the female pins that we needed, so we just soldered in the AC cord. Second, the heat sensor on the master oscillator had opened during shipping and we spent several hours with volt meters locating the problem. When we found the cause, all we had to do is push the little reset button on the sensor and everything worked fine.

(continued on page 26)

# LETTERS

Dear Editor,

I am interested in adding graphics to my system. Thomas Hameenaho (issue #7, page 2) said that only half the character generator chip is being used. Could the other half be used for simple graphic characters? If you were to offer this in an EPROM with instructions I would be your first customer. This would become the graphics standard so that us users could swap graphics programs.

The only problem I see is switching back and forth between alpha and graphics.

**John Appleton**  
702-101-14th Avenue SE  
Calgary, Alberta, Canada T2G 1C6

*Editor's note:*

*The problem you face when trying to generate graphics on the BB I is that the characters do not connect unless you do a fairly substantial modification to the video generation circuit. The disconnection means that you can't paste simple characters together to make graphic displays.*

*A number of readers are working on solutions to the graphics problem. Some are building daughter boards, others are trying to find ways to modify the original circuit with a minimum of effort and destruction. The classier the display, the more trouble it is to do. More information about that is coming up.*

*Dot graphics are obviously the most demanding. Simple, connected block graphics (similar to the TRS-80) are much easier. In fact, some folks are working on adding a 6845 and 8002A (block graphics) to the Big Board I so that both it and the BB II would run the same graphics software.*

Dear Editor,

I bought an Apple II enclosure and lid from the Computer-Center which is next door. It cost only \$60 and I thought it would give my BB a professional appearance.

The enclosure holds the board, the power supply, and most keyboards. You may have to adjust the cabinet to your keyboard with a saw and file but it is easy to do.

I also have a Shugart 801R (R stands for rackmount; it is the standard model

and is slightly shorter than the 801) in a drive cabinet. The second 801 I purchased was the non-R version. When I discovered that it was too large to fit into the cabinet, I cut some aluminum off the top of the drive chassis and off both sides of the front panel.

The new drive fit the enclosure but I could not get it to work. Obviously the metal work was too much of a shock to the mechanism. I just got it back from the disk drive service and hopefully it's OK now.

If your BB controls the AC to the drive motors, here's a hint. Break the board run to pin 2 on BB J1 (floppy interface) and then connect pin 2 to pin 7 on the power connector. Now you can pick up the power control signal at the disk drive rather than having to run an extra wire to the drive cabinet.

**Question.** Has anyone connected an electronic Olivetti or IBM typewriter to the BB? I would like to hear from that person. (Perhaps someone in Germany?)

**S. Seiffert**  
Uhlsgasse 43  
5309 Meckenheim-Merl  
West Germany

Dear Editor,

Thanks for sending Tiny Basic so quickly. I ended up not using it in the prototype of the gizmo I was working on but intend to use it on the next version (if they order any more).

Now, about adding additional memory to the BB—I have only done a paper design so far (I have to get the paying projects done first) but here are some details.

1. Change the high 16K of RAM to 5V only parts.

2. Use the WR/NOT signal path through the 74157 as the mux for the two bank select bits.

3. Replace the lower 48K of RAM with 64K chips.

4. Use the "bell" and the "spare" PIO bits to handle selection of the proper 48K bank.

5. Add an additional SIO/DART chip and baud rate generator.

6. Add a DMA chip for the floppy interface so that a 2.5 MHz system can run double density and so that interrupts don't have to be turned off during disk reads.

7. Bring up a 4-user MP/M bios for the whole mess.

I'm also working on the first segment

of "Karl's Korner" on how to stuff a BB along with a schematic for a Z80 stunt box that will single-step the BB, display registers, RAM, and trap on I/O or memory address match.

**Karl-Wilhelm Wacker**  
100 Rockaway Street  
Islip Terrace, NY 11752  
516-581-2932

*Editor's note:*

*It's going to be Christmas for a lot of folks when Karl finds the time to get these projects out. Sounds like each of us should write a "Karl-Wilhelm Wacker appreciation letter" and send it to him. (How could money possibly compete with a mailbox full of letters like that?)*

Dear Editor,

The KayPro II portable microcomputer manufactured by Non-Linear Systems is based on the Big Board. They made a few changes to the board. They used 4164 RAMs, the keyboard outputs serial data to port B of the SIO, and they changed the 1771 to a 1791 for double density (5"). The board has space for the CTC timer and for all four EPROMs but there is a socket for monitor ROM only.

The KayPro documentation shows that the memory map is identical to the BB. Very interesting.

The SCBIOS on User's Disk #2 brought life to my parallel printer! I use the Daisy Wheel II made by Ricoh and sold by Radio Shack. However, for this printer, the jumper instructions from Micro C #7 (page 2) aren't quite right. For the Ricoh, don't jumper pins 1-2 on J3.

**Jack Phillips**  
Suite 222, Park-Cherry Bldg  
114 East Park  
Olathe, Kansas 66061

Dear Editor,

I got a call this weekend about my Tandon SCBIOS on user disk #4. It looks like I forgot to mention that the CTC must be jumpered for the disk drive auto timeout. This is described in the Big Board addenda, but I'll repeat it here.

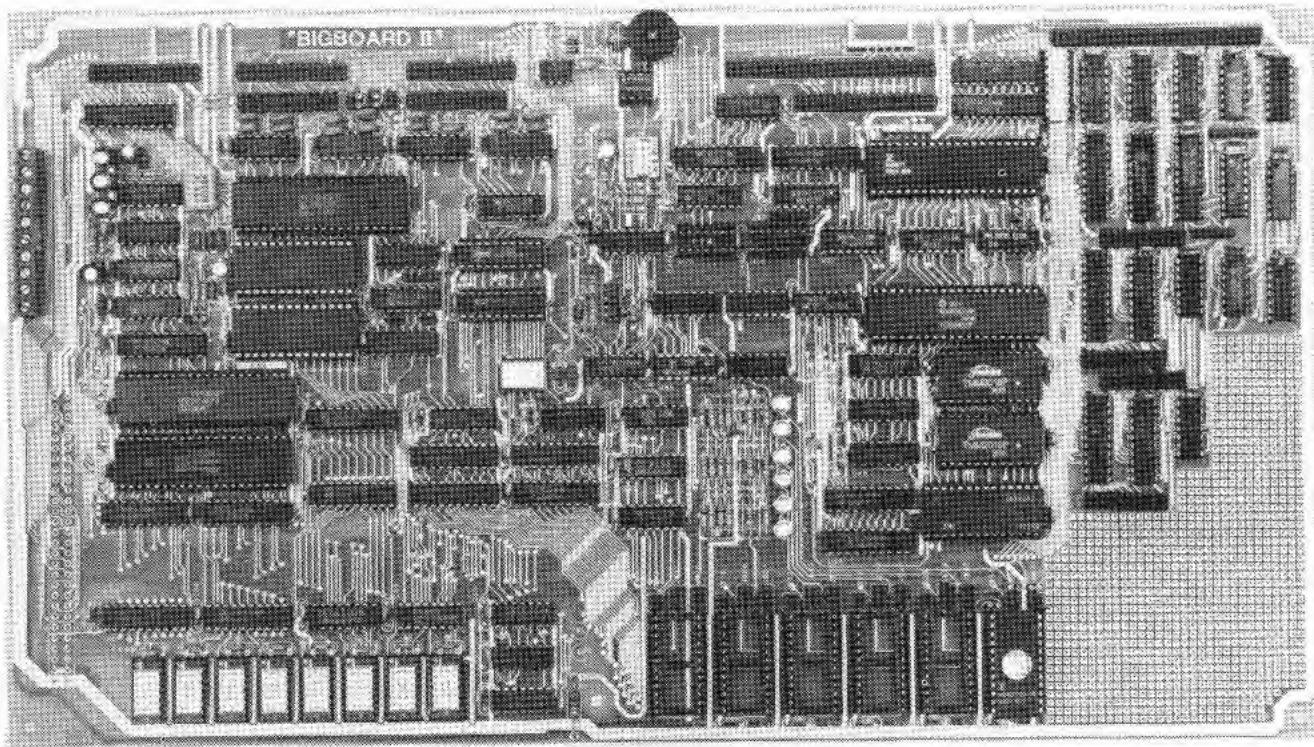
Jumper pin 3 to pin 4 and pin 7 to pin 8 (on JB2).

**Bob Edison**  
Kronos Inc  
355 Western Ave  
Boston, MA 02135

*(continued on page 14)*

# "BIG BOARD II"

## 4 MHz Z80-A SINGLE BOARD COMPUTER WITH "SASI" HARD-DISK INTERFACE



**\$895 ASSEMBLED & TESTED\***

**\$695 FULL KIT\***

**\$245 PC BOARD WITH EPROM & PALS\***

Jim Ferguson, the designer of the "Big Board" distributed by Digital Research Computers, has produced a stunning new computer that Cal-Tex Computers began shipping in June. Called "Big Board II", it has the following features:

**■ 4 MHz Z80-A CPU and Peripheral Chips**

The new Ferguson computer runs at 4 MHz. Its Monitor code is lean, uses Mode 2 interrupts, and makes good use of the Z80-A DMA chip.

**■ 64K Dynamic RAM + 4K Static CRT RAM + 24K E(E)PROM or Static RAM**

"Big Board II" has three memory banks. The first memory bank has eight 4164 DRAMs that provide 60K of user space and 4K of monitor space. The second memory bank has two 2Kx8 SRAMs for the memory-mapped CRT display and space for six 2732As, 2Kx8 static RAMs, or pin-compatible EEPROMS. The third memory bank is for RAM or ROM added to the board via the STD bus. Whether bought as a bare board, a full kit, or assembled and tested, it comes with a 250 nS 2732 EPROM containing Russell Smith's superb Monitor.

**■ Multiple-Density Controller for SS/DS Floppy Disks**

The new Cal-Tex single-board computer has a multiple-density disk controller. It can use 1793, 1797, or 8877 controller-chips since it generates the side signal with TTL parts. The board has two connectors for disk signals, one with 34 pins for 5.25" drives, the other with 50 pins for 8" drives.

**■ Vastly Improved CRT Display**

The new Ferguson SBC uses a 6845 CRT controller and SMC 8002 video attributes controller to produce a display rivaling the display of quality terminals. There are three display modes: Character, block-graphics, and line-graphics. The board emulates an ADM-31 with 24 lines of 80 characters formed by a 7x9 dot matrix.

**■ STD Bus**

The new Ferguson computer has an STD Bus port for easy system expansion.

**■ DMA**

The new Ferguson computer has a Z80-A DMA chip that will allow byte-wise data transfers at 500 KBytes per second and bit-serial transfers via the Z80-A SIO at 880 Kbits per second with minimal processor overhead. When a hard-disk subsystem is added, the DMA chip makes impressive disk performance possible.

**SIZE:** 8.75" x 15.5"

**POWER:** +5V @ 3A, + -12V @ 0.1A

**■ "SASI" Interface for Winchester Disks**

Our "Big Board II" implements the Host portion of the "Shugart Associates Systems Interface." Adding a Winchester disk drive is no harder than attaching a floppy-disk drive. A user simply 1) runs a fifty-conductor ribbon cable from a header on the board to a Xebec controller that costs only \$295 and implements the controller portion of the SASI interface, 2) cables the controller to a Seagate Technology ST-506 hard disk or one compatible with it, and 3) provides power for the controller-card and drive. Since our CBIOS contains code for communicating with hard-disks, that's all a user has to do to add a Winchester to a system!

**■ Two Synchronous/Asynchronous Serial Ports**

With a Z80-A SIO/O and a Z80-A CTC as a baud-rate generator, the new Ferguson computer has two full RS232-C ports. It autobauds on both.

**■ A Parallel Keyboard Port + Four Other Parallel Ports for User I/O**

The new Cal-Tex single-board computer has one parallel port for an ASCII keyboard and four others for user-defined I/O.

**■ Two Z80-A CTCs = Eight Programmable Counters/Timers**

The new Ferguson computer has two Z80-A CTCs. One is used to clock data into and out of the Z80-A SIO/O, while the other is for systems and applications use.

**■ PROM Programming Circuitry**

The new Cal-Tex SBC has circuitry for programming 2716s, 2732(A)s, or pin-compatible EEPROMs.

**■ CP/M\*\***

CP/M with Russell Smith's CBIOS for the new Cal-Tex computer is available for \$150. The CBIOS is available separately for \$25.

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# BB II EPROM Program

By Doug Durland

663 Georgia Ave  
Palo Alto CA 94306

The following is a listing of the EPROM programmer for those of you who want to program 2732s on your Big Board II. As you can see from the program heading it was written to be assembled by MicroSoft's M80. The two special features of this software are that it verifies it can program the ROM and that it programs only the bytes which need to be changed.

*Editor's note: These would be good features to add to the EPROM software for the BB I. Anyone want to take a stab at it? Also, both the source and the .COM files are on user disk #9.*

■ ■ ■

TITLE PROGRAMMER, 2732

This routine reads a CP/M .COM file of maximum size 4k bytes and burns it in a 2732 installed in U80 of BIGBOARD II. The 2732 is 1st checked against the code to be burned in to be sure no '0' levels are to be programmed to '1'. Note that the 2732 need not be blank. To achieve maximum speed, only those locations needing to be programmed actually receive the 50 ms programming pulse. Following programming, the 2732 is verified, and any errors reported. The program can possibly be modified to burn other PROMS, but the reader should proceed with caution. Programming requirements vary considerably.

Jumping for U-80 is as follows:

```
pin 18 to REC5
pin 20 to /OE/VPP5
pin 21 to RA11

D. H. DURLAND
663 Georgia Ave.
Palo Alto, CA 94306
(415)493-4984
```

edit 11-1-82 to remove reference to 2716's
edit 10-21-82 to include Jumper information

the program is intended to be assembled using MACRO-80

Instructions for use:

Your code should be stored in a CP/M .COM file.  
To program, for example, EXAMPROG.COM

Turn on your programming power supply.

Insert the PROM to be programmed in U-80  
Boot up CP/M to access PROGRAM.COM and EXAMPROG.COM

(the usual drive access rules apply)

Type '<x>:PROGRAM <y>:EXAMPROG.COM' <CR>(the .COM is optional)

The rest is automatic

```
FALSE EQU 0
TRUE EQU 0FFH
BOOT EQU 0
FCB EQU 5CH
BDOS EQU 5
CR EQU 0DH
LF EQU 0AH
R2 EQU 7FH
SYS1 EQU 0C8H
PROG EQU 0C0H
CTCB3 EQU 08BH
SRCMEM EQU 9000H
STACK EQU SRCMEM
ROMSIZ EQU 4096
MAXREC EQU ROMSIZ/128

; park source here
; size of a 2732
; now we move the next section to 8000 and jump to it,
; as we are going to bank switch in the PROMS and can't operate
; from CP/M
```

```

        EQU 8000H ; where some of this will run
        EQU 5000H
        EQU 0A00H ; PROM copied here
        HIGH (SRCMEM+ROMSIZ)
        EQU ENDCK

; .Z80
        ASEG
        ORG 100H

; PROGRAM: LD SP,STACK ; Underneath code to be burned
; 1st check to be sure a name has been entered.
        LD HL,FCB+1 ; 1 past drive
        LD A,(HL) ; is there a letter?
        CP Z,BUMFIL ; if not, go report no file
; now check for no type spec or .COM
        LD DE,65H ; 1st type in FCB
        LD HL,COM78L
        LD BC,3

; COMOS:
        LD A,(DE) ; get type
        CP Z,COM1 ; space OK
        JR (HL) ; ck letter
        CP (HL) ; insist on space or correct letter
        JP NZ,BUMFIL
; COM1:
        LDI PE,COM0 ; move a letter
        JP OPNFILE ; until COM moved in
        JR OPNFILE ; go open it

; COMBL:
        DEFM 'COM'
; OPNFILE:
        LD C,15 ; open file
        LD DE,FCB
        LD BDOS
        CALL OR A
        JP M,BUMFIL ; set flags
; if can't find it
        LD C,35 ; compute file size
        LD DE,FCB
        CALL BDOS
        LD HL,R2
        LD A,(HL)
        DEC HL ; middle byte
        OR (HL) ; both high bytes must be 0
        JP NZ,TOOBIG

; BURNLO: LD A,0 ; move code up
        LD (SYS1),A ; and go to it
        LD BURNLO EQU $ ; out of bank switched area
        .PHASE PRAM
; BURNIT: LD A,0 ; switch in the PROMS
        LD (SYS1),A ; out of bank switched area
        LD OUT EI ; 1st we check the PROM for 0-1 transitions
        LD HL,SRCMEM ; source code
        LD DE,ROMLOC ; PROM address
        LD A,TRUE ; initialize assuming OK
        LD (BITSOX),A
; CKLOOP: LD A,(DE) ; get a PROM byte
        OR (HL)
        LD B,A ; save with (possibly) extra bits
        LD A,(DE) ; get PROM again
        CP B ; if no bits went up
        JR NC,CKADUP
        LD A, FALSE ; if FALSE
        LD (BITSOX),A ; flag for message at end
        JP ROMOUT ; go back to CP/M
; CKADUP: INC HL ; at this point we know that the PROM is at least theoretically
        INC DE ; programmable. Copy it into ROMCPY for reference.
        LD A,H ; 1 past end
        CP ENDCK ; for 4k bytes
        JR C,CKLOOP ; move it
; at this point we know that the PROM is at least theoretically
; programmable. Copy it into ROMCPY for reference.
        LD HL,ROMLOC ; PROM
        LD DE,ROMCPY ; copy destination
        LD BC,ROMSIZ ; byte count
        LD LDIR ; move it
; here is the actual burn
        LD B,3 ; source code
        LD C,PROG ; PROM address
        LD HL,ERNTBL ; table of output words
        LD OTTR ; get set
        LD HL,SRCMEM ; source code
        LD DE,ROMLOC ; PROM address
        LD BC,ROMCPY ; copy address
        JR BURNLP ; and do it

```

(continued on next page)

```

; BURNBL: DEF8 8 ; to disable PROM outs, enable U-57 outs
; DEF8 9 ; to disable PROM /CS lines
; DEF8 0CH ; to turn on program voltage

; BURNLP: LD A,(BC) ; PROM copy
;          CP (HL) ; same as source?
;          JR Z,BURN9 ; skip burn if so (save time)

; LD A,(HL) ; get source
;          LD (DE),A ; latch it to PROM for burn

; LD A,1 ; /DECODE 1 low thus /CS low
; OUT (PROG),A ; save copy address
;               ; millisecond count

; PUSH BC ; get current count
; LD B,50 ; it becomes reference
;          LD C,A ; save copy address

; CNTMS: IN A,(CTCB3) ; MOVE4 converts the address to ASCII and moves it to the message area
;          LD C,A ; get current count
;          INC A,(CTCB3) ; it becomes reference
;          CP C ; change?
;          JR Z,MSCHG ; until a change

; DJNZ CNTMS ; do 50x 1 millisecond
; POP BC ; retrieve copy address

; LD A,9 ; /DECODE high thus /CS high
; OUT (PROG),A ; can get here if PROM=source
;               ; (see BURNLP+2)

; BURN9: ; PROM is now burned. Time to verify it.

; INC HL ; table to go back to normal
; INC DE ; go back
; INC BC ; and verify
; LD A,H ; for 4k bytes
; CP ENDCK ; 1 past end
; JR C,BURNLP ; and verify

; NRMTEL: LD B,3 ; to turn off program voltage
;          LD C,PROG ; to enable chip set decoder
;          LD HL,NRMTEL ; to turn off out buff and enable PROM
;          JR VERIF1 ; advance to next slot

; DEF8 4 ; to turn off program voltage
; DEF8 1 ; to enable chip set decoder
; DEF8 0 ; to turn off out buff and enable PROM

```

```

; Report receives DE pointing to the bad PROM byte and HL pointing
; to the source byte. HL is a relative address.

REPORT: PUSH DE
        PUSH HL
        CALL MOVE4 ; move address into message
        LD A,(DE) ; get bad PROM byte
        LD DE,ERRMS4 ; move bad PROM byte to message
        CALL MOVE2 ; get source byte
        LD A,(HL) ; move to message
        LD DE,ERRMS6 ; print the error message
        CALL MOVE2 ; if we get here at all, we have a problem
        LD DE,ERRMS1 ; move to message
        CALL MSG ; if we get here at all, we have a problem
        POP HL
        POP DE
        LD A, FALSE ; (ROMOK),A
        LD DE, (ROMOK),A ; if we get here at all, we have a problem
        RET

MOVE4: PUSH DE
        LD DE,ERRMS2 ; move to message
        LD A,H ; modulo 4k
        RES 7,A ; move H to message area
        CALL MOVE2 ; and L
        LD A,L ; move to message
        CALL MOVE2 ; DE
        POP DE
        RET

MOVE2: PUSH AF
        RRA RRA ; get high nibble into low
        RRA RRA ; and move it
        CALL MOVNIB ; restore entire byte
        POP AF ; only low part of interest
        AND OFH A,90H ; convert to ASCII
        ADD DAA A,40H ; put it in the message area
        INC DE ; advance to next slot
        RET

```

VERIFY:

; 1st we copy the burned PROM into ROMCPY

ROMOUT: LD HL, ROMLOC ; PROM  
LD DE, ROMCPY ; copy destination  
LD BC, ROMSIZE ; byte count  
LDIR ; move it

; Now switch out the PROMS and go back to CP/M for verification.

ROMOUT: DI A,8  
LD (SYS1),A ; switch out the PROMS  
OUT EI  
JP VERIFY ; go do the verification

; BRNEND EQU \$

BITSOK: DEFS 1 ; goes false on 0 to 1 transition request  
ROMOK: DEFS 1 ; goes false on bad verify

; .DEPHASE

VERIFY: LD A,(BITSOK)  
OR A  
JP Z,BITNG ; go report no try

; LD DE,CRLF ; else do the verification

CALL PMSG ; put crlf

; LD A,TRUE  
LD (ROMOK) A ; assume ok

LD HL, SRCMEM ; source start

LD DE, ROMCPY ; PROM copy

; VLP: LD A,(DE) ; get a PROM byte  
CP (HL) ; match?  
CALL NZ,REPORT ; if not  
INC HL  
INC DE  
LD A,H  
CP ENDCK ; 1 past end  
JR C,VLP ; catch all bytes

; LD A,(ROMOK)  
OR A  
JP Z,FINIS ; if not ok, no reporting to be done

; LD DE,VERMSG ; else report success, and quit

CALL PMSG  
JP FINIS ;

; this area contains abort routines and messages

BITNG: LD DE,BITMSG  
CALL PMSG  
JP FINIS

BITMSG: DEFN CR,LF,'Bits not all blank. Not programmable.'  
DEFM '\$'

BUMFIL: LD DE,FILEMSG  
CALL PMSG  
JP FINIS

FILEMSG: DEFN CR,LF,'Improper file specification',CR,LF,'\$'

TOOBIG: LD DE,BITMSG  
CALL PMSG  
JP FINIS

BIGMSG: DEFN CR,LF,'Too big for PROM',CR,LF,'\$'

BURND: LD DE,RDMSG  
CALL PMSG  
JP FINIS

RDMSG: DEFN CR,LF,'Bad read, aborting',CR,LF,'\$'

PMSG: LD C,9  
CALL EDOS  
RET

ERFMS1: DEFN 'Relative'

ERFMS2: DEFN 4 ; will hold address

ERFMS3: DEFN '='

ERFMS4: DEFN 2 ; will hold bad PROM byte

ERFMS5: DEFN ' should='

ERFMS6: DEFN 2 ; will hold source byte

CRLF: DEFN CR,LF,'\$'

VERMSG: DEFN 'PROM verifies OK',CR,LF,'\$'

FINIS: JP BOOT

; END

# Big Board Fixes

By Ewing Waymire

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Not all Big Boards work when first powered up, so the purpose of this article is to help those who don't get that sometimes elusive "system monitor 3.3."

## Background

First, a little information about the PFM monitor. At power-up, the processor starts executing code from location 0000H in the ROM bank. The first 16 instructions in the ROM move the rest of the monitor to high memory starting at F000H. Following the move, control is transferred to F000H.

If PFM is copied correctly, if the RAM at F000H is good, and if there are no other basic problems in this part of the system, then PFM will start its tasks.

PFM does a number of things before it can accept an input and sign on. It deselects the ROM bank, clears the video RAM, initializes the system PIO, SIO, CTC, and 1771. Next it checks to see if you have an SIO and if so, it starts polling both the SIO and the PIO to see which receives a carriage return character first.

You can watch this polling process by checking the chip enables of the PIO and SIO to see if the processor is alternating selecting one and then the other. If the monitor finds that an SIO is not installed, then it goes ahead and signs on and waits for characters from the PIO.

Let's go down the list of the most common problems and see what usually works.

## Is It a Dead Processor?

The first thing you need to check on a bad board is whether the processor is running. Check the M1 line (is pin 27 wiggling up and down?) to see if the processor is fetching opcodes. If it is not running, then either it is not receiving a good clock signal (pin 6) or it is being held in a constant reset (pin 26 stays low).

If you find either of these problems, recheck all the related components to make sure they are in their proper places and not interchanged with others or installed in a feed-through hole. R43 is the most often misplaced component in this part of the board and people often interchange Q1 and Q2. Q2 helps make the

rise time of the clock short enough to meet Z80 specs. It must be a 2N2907.

## Alternating Character Display

If the processor is running you will find that the on-board video is a very powerful debugging tool. A repeating pattern of boxes and colons is called a stack crash. It usually means that the processor is running but it is not able to execute PFM. Usually this is caused by a bent pin on a RAM chip (this is hard to find so look carefully) or it happens when someone substitutes 74LS157s for the 74157s in U58 and U59. The LS parts won't work here.

Other common mistakes include unsoldered or badly soldered pins, switched parts, or defective RAM (especially the top 16K). You only need RAM chips U1 through U8 installed in order for PFM to sign on. Also, the Z80 is the only 40-pin chip that has to be installed in order to get the magic prompt.

## Other Visible Problems

If you are getting more than one prompt or the screen hasn't been completely cleared at sign on, then the trouble most likely is in the 74LS157 area. Again, look for bent pins or switched parts. If you move parts and the trouble changes, that should give you a clue.

If the characters on the screen slowly swim back and forth, check the video crystal. The documentation calls for 14.31818 MHz but the proper crystal is 13.9776 MHz. This provides a true 60 Hz vertical sync rate. If the new crystal causes the characters to tear, then replace C24 with a 10 pf capacitor or reduce R2 to 470 ohms.

If the dots on your screen jitter, then you probably have some noise leaking into the video. Add some bypass capacitors to the +5 V line near the video section. (Editor's note: try some 50 mfd 10V tantalums between the +5 V line and ground.) Also, swapping or changing U38 and U51 will sometimes clean up the problem.

If the first half of each video character is missing then you may have mis-installed the 1.5K resistor at R21. It is easy to mistake a feedthru for the component pad on this part.

## Keyboard

If your keyboard is not hooked up properly (bit 7 is not grounded or driven low) the BB will answer all or some of the commands with "what." Also, a defective 74LS14 (U112 or U114) can lead to a bad case of "what."

## Disk Drives

If you have two drives jumpered as drive 0 (LEDs turn on together) then you may destroy the system tracks (0 and 1) on your disk.

## SIO

A lot of people don't realize that there is a difference between an SIO/0 and an SIO/1 or 2. By the way, a DART will work just as well as an SIO as long as you do not plan any synchronous communications. (And who wants to do synchronous work anyway?)

## Other Thoughts

If your -12 V supply fails while a disk is loaded, the 1771 will write garbage on the track where the head is, destroying both the data and the formatting. If your -5 V supply goes positive, your 4116 RAMs may be damaged. So, you should double-check your power supplies if problems occur.

Although our customers are some of the best computer whizzes around, 9 out of 10 boards we get back for repair have at least one IC pin bent under or out, or have bad solder joints.

The memory test is not infallible. We have seen cases where bad memory chips have passed the test. If your programs act weird and your power supplies and software are OK, then suspect the RAM. Swap rows of memory around to see if the problem changes.

## Finally

About 19 out of 20 BBs work on the first try. I hope the above hints will help with the other 1 out of 20.



# Relocating Your CP/M

By Pseud O. Nym

In Micro C #2, Dave notes that in the CP/M distributed with the Big Board, the BIOS starts at E800, while most 60K versions start at EA00. You can modify the BIOS definition and reassemble the CBIOS but it is still necessary to relocate CP/M to accommodate this CBIOS. Many of you with the BB version may, like myself, want to return to the standard CP/M EA00 BIOS to recover the wasted space and be compatible with the majority of 60K CP/M systems. (I had to laugh at the note about maintaining consistency—we would have been consistent if we'd stayed with the CP/M standard.)

MOVCPM contains a relocatable copy of CP/M, a BOOT, and a BIOS. Whenever you run MOVCPM, it modifies all of these. If your MOVCPM includes a BOOT and BIOS suitable for your hardware, fine. Otherwise you have to overlay the relocated system with suitable programs. However, MOVCPM only allows relocation in steps of 1k bytes—so you can set up the BIOS at EA00, E400, DA00, etc.

The version of MOVCPM distributed with the Big Board has been modified to deposit the code 512 bytes lower than the standard version. Thus, MOVCPM 60 gives you a 59.5K system! You can duplicate this feat or defeat it by adding a patch to your MOVCPM program.

This patch modifies MOVCPM's size calculation. When execution reaches location 016FH, the HL registers contain the specified system size (e.g. F000H for a 60K system). If you add anything to or subtract anything from HL at this point, the resulting system will be larger or smaller.

Voila! To make the BB MOVCPM work like the standard version all we have to do is add 200H to HL here.

This is how I patched MOVCPM.

DDT MOVCPM.COM	
L16F	check that 16F is JP 1A5
A16F	
JMP 2A00	jump to patch (don't forget this period)
A2A00	assemble code at 2A00H
PUSH B	save BC
LXI B,200	to convert E800 to EA00 or LXI B,FE00 to subtract 200H
DAD H,B	add BC to HL
POP B	restore BC
JMP 1A5	where it was heading end of assembly
G0	"go zero"
SAVE 42	
MOVCPMX.COM	

I should note that I have only tested this for converting the BB MOVCPM to standard. Also, your MOVCPM may not be the same length as mine. I put the patch at 2A00 because DDT reported that as NEXT when I loaded MOVCPM.

After this, you can follow the CP/M documentation for "Second Level System Generation." (See page 6 of the CP/M Alteration Guide.) Note that when using the BB MOVCPM you must add 200 to the read offset for the BIOS. This makes the offset 3780.

#### Editor's note:

*This is one of those really significant pieces of information which gives us all a chance to org at EA00. You can reassemble your present BIOS (use the SD Systems assembler on the original source) or go ahead and install an updated BIOS such as the one from user disk #2 or #9.*

*Also, the author asked not to be identified so I gave him the best pseudonym I could think of. Sorry if I was too obvious.* ■ ■ ■

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# Xerox 820 Notes

Column by John P. Marlin, Jr.

As promised, I'm back again, and the Xerox 820-II (R) board has been dissected, also as promised. What a difference! I scarcely know where to begin. I'll refer to the old board as an 820, and the new one as an 820-II.

It looks like Xerox has gotten serious about the microcomputer market. They have done a lot of the "Personal Computer" stuff but this one is definitely a Business Machine.

## Appearances

The 820-II has the same old 4 connectors and reset button across the back edge, and same good RFI-EMI attention, but now, all of a sudden, there are a couple of edge connectors on the mother board, and one of them has a PCB in it! Also, fewer ICs, and more space between them. Removing the disk controller made a lot of space on the mother board.

There are two different boards available for the controller slot, a floppy controller, and a hard disk controller.

The other slot is an expansion connector, nearly one-for-one with the controller slot, but obviously intended for memory, or like that.

The hard disk board is only a SASI interface, since Xerox now has a box (the U07) which contains a Shugart SA1403-E Intelligent Controller, an SA1004 8-inch, 8-meg (formatted) Winchester, an SA801 SSDD floppy drive and an extra connector for another 2-drive cabinet. Thus you can connect three floppies and a Winchester!

## The Controller

The controller is a 1797 which allows double-sided double-density floppies, with side checking on address headers. However, the chip is limited to 256-byte sectors.

John MacFarland, of Software Publishers, tells me he has one running 1K sectors with a 1793. He is using essentially the same double density software he supplies with the double density kit for the Big Board. The rest of the floppy controller is pretty much the same as the old 820, with the addition of a write precompensation circuit (a double density necessity).

## The Kernel

CPU: 4.0 MHz Z80-A with 8.0 and 16.0 MHz clocks available on the board. As with the old version, nothing significant here.

CTC, SIO, and PIOs are the same as on the 820.

MEMORY: Now we see some differences. For instance, Bank Select (bit-7) turns off everything up through BFFFH. The second edge connector (memory expansion) has \*MEM4 and \*MEM8 signals which are decodes of the second and third 16K segments when the second memory bank is selected. CP/M 3.0, anyone? Additionally, the expansion slot has \*RFSH, and all the other normal bus signals almost like STD-BUS. A pity they didn't use the STD-BUS pinout.

There are the usual 4 2716 sockets, but the upper two have jumpers to feed the WR (write) signal to pin 21 for 6116-type RAM. Currently, 3 sockets are occupied by ROMs. All 4 sockets run with wait states.

CRT RAM: is a 2016 2Kx8 chip running with a wait state.

The ROMWAT (ROM wait) can also be accessed from both the Disk Controller slot and the Expansion slot, as needed.

Lots of new I/O ports defined. SYNC/ASYNC select, SGL/DBL density, CHARGEN1/CHARGEN2, set DIMVIDEO, and (at last!) SET/RESET ALARM. Yes, Virginia, there really is a beeper!

Slight changes to the System PIO bit definitions. Bit 5, not needed for the bell, now senses double-sided floppies.

## Monitor

Here there is a real difference! On reset, the following happens:

1. SP, HL, and last word of stack are stored beginning at FFE0.
2. The Copyright disclaimer is executed. You heard me, they actually execute the copyright characters. And, since they have eliminated the spaces in the text (you know, those troublesome JR NZ's) the result is a bunch of harmless LD's. Saves 2 bytes not to JR around it! This, it turns out, is the beginning of some of the tightest code ever written by mortals!
3. Clear and initialize the CRT;
4. Non-destructive test of RAM from F000-FFFF;

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5. Checksum test on 3 of the 4 ROMs;
6. Initialize FF00-FFFF data (the old LDIR loop);
7. Initialize the I/O ports (ditto OTIR);
8. Initialize CPU. Mode 2, FFXX vectors;
9. Move the F000-FEFF image into place;
10. Checksum test on fourth ROM. Fail says jump to entry in HIMEM;
11. Test for 55AA just below checksum in fourth ROM. Fail says jump;
12. Load HL with Command Address Table;
13. Load DE with DSKMAP;
14. Load BC with HIMEM entry address;
15. Call ROM4;
16. Jump to HIMEM entry address (FC55).

ROM or RAM errors detected move appropriate message to CRTMEM directly, time out, and re-jump to 0000.

After all this, the SIO is initialized. (Even Parity with DTR and RTS set on both channels.) Channel A is set for 300 BPS, B at 1200. The PIO is initialized for a Centronics interface.

## High Memory

HIMEM entry. After we finally get here, we still have bits 6 and 7 of the System PIO as outputs, and all others are inputs, for the moment. Bit 0 is held low by the SASI I/F, so we start moving storage addresses and driver addresses around. Bit 4 is held low by 5 1/4" drives, so we move some DPE's and modify DPH's. Finally, we display the startup message and wait for keystrokes.

Oops! new message! "H Host Terminal" Yes, we can look like an ADM3A. Better yet, from the KBD we can do local copy for those pesky IBM systems, or, still better yet, remote echo to look like a CPU to some remote dumb terminal. Innovation! As each line scrolls off the top of the screen, it is written to RAM in 80 byte chunks, starting at 0100H, just like in CRTMEM. No CR's, no LF's, just an image of CRTMEM. Holds about 700 lines. Do one of those, then boot CP/M and SAVE 220 FILENAME.EXT and you got it!

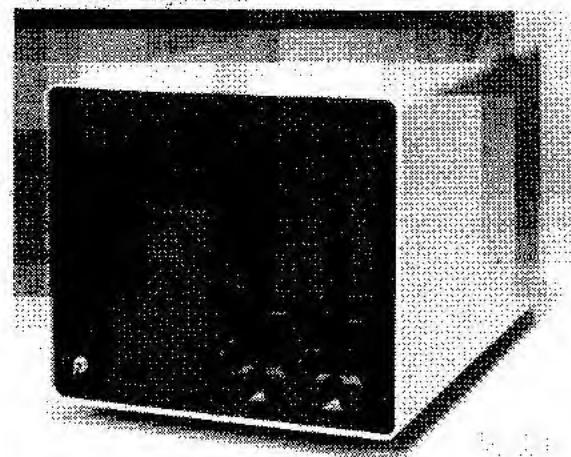
(continued on page 12)

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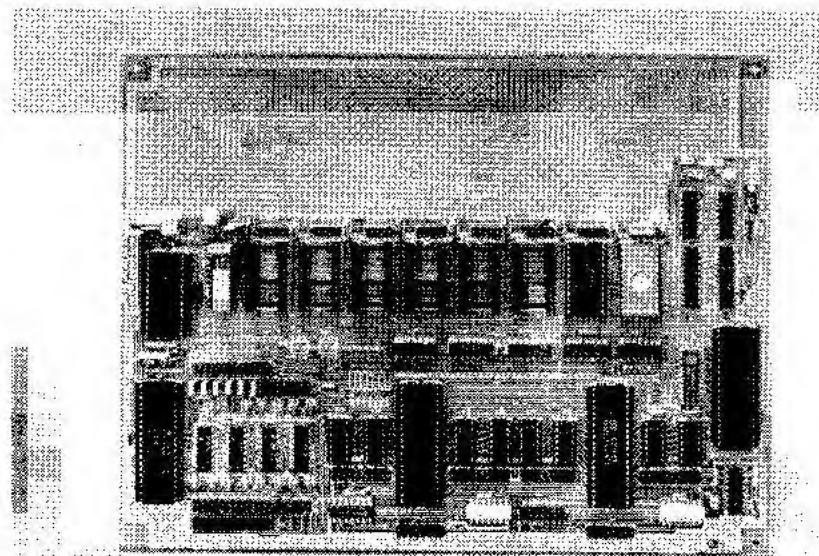
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# The Disk is the Media

By David Thompson

Researching this article was a real learning experience for me. It was particularly enjoyable both because I'm interested in the subject and because I got a chance to chat with some very interesting people. I found that the magnetic media market has its own language, its own pecking order, its own hype, its own secrets, and its own technical gurus.

My technical sources include Tektronix, Colin Thompson of BASF, Marilyn Gilman of Memorex, and Dale Isaacs of Dysan.

## Background

There are two ways of putting recording material on a disk. The oldest and most common way is called knife coating and everyone but Maxell appears to be using this method. The method Maxell now uses is called roto gravure, and is a very similar to the precision printing technique of the same name.

The roto gravure technique is new to disk manufacturing and though it pro-

vides the best control over emulsion thickness, Maxell hasn't figured out how to produce a smooth, non-abrasive surface. (They are working on it night and day.) It turns out that the thinner the coating, the higher the data density because the magnetic information written onto the disk surface cannot fan out as far when the coating is very thin. And this new coating method makes it possible for Maxell to make their coatings thinner because they are so consistent.

Meanwhile, they are having a problem with abrasion. The tiny particles of iron oxide that store the information are quite abrasive, so it's important to make the disk surface as smooth as possible and impregnated with lubricant. It's also important that any particles kicked loose by the head be picked up immediately by the fabric envelope liner because these particles can damage the head and damage the disks that follow.

## Media life

I asked Colin Thompson, the BASF

technical rep, about differences between brands in terms of media life. He said that all the manufacturers have advanced to the point where the media would last practically forever if users would handle the disks properly. Bending, dust, and fingerprints are now the primary determinants of disk life. (You should see how folks ship disks to me. Shame! Shame! You must keep them in their envelopes and mail them in real boxes.)

Occasionally a manufacturer will go off on a tangent. An example of this is Verbatim's attempt to use aluminum oxide (doesn't sound very magnetic does it?) in place of iron oxide. Those disks haunted Verbatim for a long time. In fact, I had some and they were so bad that I still don't trust Verbatim (though from what I've found out, I really shouldn't distrust them now).

During the time when Verbatim was having its problems I bought a number of BASFs. I had absolutely no problems with them. However, this spring I had

(820 Notes continued)

However, we type "LAret>" and more happens in HIMEM. Overlays! The first letter brings in an overlay from ROM into the aforementioned HIMEM EMTRY address and is executed there. Sooner or later we get a very sheepish, one-line greeting from CP/M. We're up!

DIR brings back strange files. CONFIGUR.COM. WHATSA.COM. BACKUP.COM. A bunch of funny others. What are they?

CONFIGUR allows a disk image or a memory image to be patched in many wonderful ways. I/OBYTE, 7/8-bit KBD, floppy step rate, auto-restart filenames, video attributes, hard-disk partitions. Several tables are stored in HIMEM to make CONFIGUR work, including addresses of "AND A,7F" (reset keyboard bit 7) instructions and such.

By the way, we don't call F000-jumps for SETDMA, SETSEC, SETTRK, SELDSK, READ, and WRITE from BIOS. Now we request "Execute Physical Device Driver", specifying a 9-byte table in HL. That's all. The table has logical drive, sector, track, DMA, and com-

mand. HIMEM code equates logical drive to physical drive, finds the appropriate driver, and does it. Almost magic.

CONST, CONIN, CONOUT are replaced with logical CONST, etc. which, in turn, is steered with the contents of I/OBYTE. Same for LIST.

In addition to all these magical entrances, all the old ones are still where we expect them, so 820 BIOS runs on 820-II hardware. Single density, only, of course. Code's all there to fake them.

## Back to the 820.

Seems as though the surplus 820 boards became available after I wrote the last column, but before it got printed, so you have the word on the Rondure (Dallas) offerings at \$435.00. Even at \$399.00 for the BB kit, if you add the SIO and CTC options, as well as the pre-soldered socket option, the 820 board is cheaper, and, has been tested as a running system. Hard to beat!

It should fit into nearly any old CRT case in place of the old logic (especially the single-board designs) and use the old keyboard and CRT monitor assembly, as well as the power supply. Also, as

mentioned last month, the 820 board supports 5 1/4" floppies. Rondure has schematics for the 820 at \$5.00 apiece, although I don't know if the prints are available separately. If not, I have prints for the same price.

## Coming Up

Next issue I will talk about the slick non-destructive RAM test used in the 820-II, as well as the improved CRT handler and the new monitor entry points. See you then . . .

## About the last column:

I made an error on last issue's info. It's the RIGHT ARROW, not the DOWN ARROW, which sends 'C. Sorry.

## Editor's note:

John caught an error I added while editing his last column. He pointed out that 5" drives do not do their own data separation, as there is no line on the interface for FDCLK. The 8" separator is used just as on the BB, and the internal separator of the 1771 is used for 5" just like Radio Shack did, to their eternal embarrassment.

# XEROX

## 820

### CABLES

problems with two batches in a row. I had a marginal drive but the BASFs were the only disks that it threw up on.

According to Colin Thompson the BASF technical rep, the disks produced in 1981 (the last character of the ID # on the back is a 1) had problems. I checked, and all my flakey disks ended in "1." He says they have done a major re-engineering for 1982 (the number ends in "2") and they have not had any of the new ones returned.

#### Drive problems

Colin also mentioned that many of the complaints that disk manufacturers are now seeing are a result of drive problems. He noted that the drive manufacturers are not taking the time to align the drives as precisely as they used to (because of the volume of drive orders) and that OEMs and dealers are not set up to do it.

#### Similarities

All manufacturers start out with essentially the same raw materials. They all use the same type of mylar base and use nearly identical materials to formulate the coating.

First the manufacturers mix the raw materials into a slurry (the recipe is precisely dictated by an ANSI standard) and then they coat the mylar base with the slurry. They wind up with large rolls of coated material from which they cut the disks. The disks are polished and then tested. It is only during the testing process that disks are separated into single or double sided and single or double density.

#### Differences

The differences between brands appear primarily to be differences in the lubricant, the polishing, the testing, and in the envelopes.

All of the manufacturers have full time labs to keep on top of changes in the quality of the product. The manufacturers are: Athana, BASF, CDC, Dysan, IBM, Maxell, Memorex, Nashua, Scotch, Verbatim, and Wabash. All other brands use material made by one or more of these folks. (And even the above folks fill out their own product lines by purchasing finished and unfinished product from other manufacturers.)

Dysan, for instance, buys coated rolls (called tape) of raw 8" material from Scotch because they haven't perfected the coating process for this size. However, they have perfected the burnishing and it's only been recently that other manufacturers have figured out how to match Dysan's high quality finish. Meanwhile Dysan is trying to increase its production substantially. It'll be interesting to see whether they can maintain their high quality during the expansion.

#### Vague Conclusion

So the question still comes down to whose disks are best and whose are the best deal for the money. Dysans are premium disks but you definitely pay for that quality. Maxell is trying to compete with Dysan in the quality market but they are going to have to get their finishing worked out and they aren't cheap. Maxells probably will never be cheap because their marketing agents cut off supplies to anyone caught discounting too much.

Beyond that, it's up for grabs, and various brands of disks have done well or poorly depending more on the phase of the moon (or so it appears) than on brand name. Slight changes in one of the raw materials or in one of the manufacturing processes can have a significant effect on the quality of the product.

Most manufacturers strive to keep the number of defective disks down to one percent. (This is the percentage of disks that customers return, which is not necessarily a good indication of the actual percentage which are bad.) Between two and four percent of my Scotch disks are bad. Colin has said that he hasn't seen any returns of the 1982 BASF disks (the last digit of the number on the back is a 2). They had lots of returns of their earlier product.

It sounds to me as if most of the disk manufacturers have gotten their trips together. If so, there are some real bargains available in the disk market. I've started testing a batch of the new BASFs and haven't had any problems so far. If you want to try some of their latest disks, look for the boxes with "qualimetric" stickers on them. ("Qualimetric" must be another word for 1982.)

■ ■ ■

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# FORTHwords

Column by Arne A. Henden

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A lot has happened in the FORTH world over the last couple of months and we may have passed a new milestone. This month's column includes information from two new contributors, Philip Plumbo and Ward Harold. We welcome user contributions, especially when they are of this quality!

## Dr. Dobb's Journal

In case you haven't been following the computer magazines closely, each magazine tends to have a monthly theme. The first issue devoted to FORTH was the August 1980 issue of BYTE. This single issue probably doubled the number of FORTH users!

Since then, Dr. Dobb's Journal (DDJ) has had two FORTH issues, first in September 1981, and again in September 1982. This latest FORTH spectacular is one of the best mix of applications I have seen.

They have included Joe Barnhart's binary, relocating, linking FORTH loader (mentioned in the last column); a complete floating point package, in both high-level and assembler; an H-19 screen editor; a Z-8000 FORTH; and a programming style article. Almost as good as the articles are the numerous ads. I suggest ordering a copy before DDJ runs out.

## Correction

In the last column there was a typo in Hampton's screen. For ?TERMINAL the 2BCD should have been 2BC3.

## The FIG National Convention— by Philip Plumbo

The FORTH Interest Group presented its fourth annual National Convention on Saturday, October 9, in San Jose, California. The turnout was impressive (over 500 people), as was this year's expanded schedule of seminars. For the first time in FIG's history, the number of lectures exceeded the time available, and so lectures ran in parallel throughout the day. (Unfortunately, they were all top-notch, making it difficult to choose which to attend).

The Standards Committee gave an update on its work of the past year, reporting that the task of defining FORTH-83 was proceeding smoothly and without

the squabbling that marred past efforts.

Other seminar topics included energy control applications, a multi-tasking FORTH system, debugging and development tools, and the latest video games (from Atari of course).

Charles Moore and Elizabeth Rather chaired a seminar on the use of FORTH in digital image processing.

Other panels discussed the use of FORTH in industrial and process control, business applications, computation, video mixers and television commercial production, university engineering courses, and data transmission via amateur radio packet switching networks.

The commercial display area was a busy spot, and the vendors were out in force with their latest FORTH language systems and various development tools. FORTH, Inc. demonstrated its poly-FORTH II for the IBM-PC, a multi-tasking FORTH that includes hardware floating-point support for the 8087 numeric processor, and on-line system documentation.

Their floating-point implementation uses a separate floating-point stack, and their floating-point words operate only on that stack. Their demonstration included a set of matrix multiplications which appeared to run almost instantly. If you've ever done any matrix algebra

```
SCR # 255
0 ( FORTH DIMENSIONS INTERRUPT HANDLER )
1 VARIABLE SPTMP      NEXT-LINK 4 - CONSTANT RETP
2
3 : (POP.REG) ( registers - )
4     ASSEMBLER HL POP, DE POP, BC POP, AF POP, FORTH ;
5
6 : POP.REG ( registers - )     ASSEMBLER SPTMP ) SP LD,
7     HL POP, HL RETP ) LD, IY POP, IX POP, (POP.REG) EXX,
8     AF' AF EX, (POP.REG) FORTH ;
9
10 CODE RTI ( registers - )    POP.REG EI, RETI, END-CODE
11
12 : INTERRUPT ( - )    NOOP RTI ;
13
14 : (SAVE.REG) ( - registers )
15     ASSEMBLER AF PUSH, BC PUSH, DE PUSH, HL PUSH, FORTH ;
```

```
SCR # 256
0 ( FORTH DIMENSIONS INTERRUPT HANDLER COMMENTS )
1
2 SPTMP holds the stack pointer      RETP is the address of the
3 during interrupt service          return stack pointer
4
5 (POP.REG) is a macro which generates code to restore a reg set
6
7 POP.REG is a macro which generates code to restore the machine
8
9 RTI is the return from interrupt word, it restores the machine,
10 enables interrupts and returns
11
12 INTERRUPT is the high level interrupt word, NOOP is a place
13 holder for the high level service routine
14
15 (SAVE.REG) is a macro which generates code to save a reg set
```

```
SCR # 257
0 ( FORTH DIMENSIONS INTERRUPT HANDLER )
1
2 : SAVE.REG ( - registers )     ASSEMBLER (SAVE.REG)
3     AF' AF EX, EXX, (SAVE.REG) IX PUSH, IY PUSH, HL DE EX,
4     RETP ) HL LD, HL PUSH, HL DE EX, SP SPTMP ) LD,
5     S0 @ 128 - SP LD, FORTH ;
6
7 CODE INTERRUPT.SERVICE ( - )
8     SAVE.REG ' INTERRUPT HL LD, NEXT-LINK 1+ JP, END-CODE
9
10 : >INTERRUPT ( - )    [COMPILE] ' CFA ' INTERRUPT ! ;
11
12 : VECTOR.INTERRUPT ( addr - )    ' INTERRUPT.SERVICE SWAP ! ;
```

with your micro, you know how impressive that is.

Creative Solutions, Inc. showed a FORTH for the Hewlett Packard 68000-based computers. Their demonstration included various animations, high-resolution graphics routines, music-synthesis, and a FORTH interpreter all running "simultaneously." You could shift from one task to another with a few simple commands.

C. H. Ting displayed a Chinese-character generator/symbol processor capable of creating and manipulating any ideogram interactively.

The friendly people of Mountain View Press were there with a long table

stacked high with the latest FORTH publications. The 1982 *Proceedings of the Rochester FORTH conference* (on data-base and process-control applications), Haydon's *All About FORTH*, *The FORTH Encyclopedia* by Derick and Baker, and Huang's *And So FORTH* attracted lots of stand-up readers to the MVP booth.

Mr. Kogge, a senior engineer in advanced system architecture for IBM and adjunct professor at SUNY-Binghamton, gave the keynote address titled "On Removing the Magic from FORTH." Mr. Kogge cautioned the FORTH community that "If we wish to avoid being confined to the dustbins of technology we must make a conscious effort to de-mys-

tify what we have." He urged the audience to spread the FORTH word widely, especially in "recognized" literature, reminding us that FORTH is virtually unknown in industry and academia. Those few people that have heard of FORTH often know it only as a "write-only language" or "a variant of assembler."

#### A High-Level Interrupt Handler— by Ward Harold

The March/April FORTH Dimensions (vol. 4, no. 2) published an interrupt handler designed to allow the use of high-level FORTH words. When the interrupt occurs, the machine state is saved, the high-level word's code field address is loaded into the interpreter pointer, the word is executed, and the machine state is restored.

Ward Harold of E. R. Squibb & Sons, Inc. has modified the Fig version to work with UNIFORTH. Ward's version is presented here as an excellent example of well-documented FORTH. He has used CTC 0 and 1 as a one-second interrupt counter for an example of the handler. Several Macros (POP.REG, SAVE.REG and their parent versions) are used to clean up the source code. If you still have any questions then read the original FORTH Dimension article or check with one of us.

A high-level interrupt handler buys you transportability and ease of coding. You lose speed because all registers have to be saved and restored, and a high-level word executed. For slow interrupts (spaced more than 0.01 second apart), the high-level handler will work fine.

#### Next Month

The FORTH-83 preliminary standard is just about ready to be released, and the next column will include a summary of the changes. Plus, we'll cover new commercial versions of FORTH and examples of FORTH in OEM instrumentation.

Future subjects include a label maker, Epswriter (using your MX-80 as a typewriter), and hard disk interface. Best holiday wishes to all!



```
SCR # 258
0 ( FORTH DIMENSIONS INTERRUPT HANDLER COMMENTS )
1
2 SAVE.REG is a macro which generates code to save the machine
3
4 INTERRUPT.SERVICE is the code word which the interrupt is
5 vectored to; it saves the machine, loads the IP with the PFA
6 of INTERRUPT and jumps to the inner interpreter
7
8 >INTERRUPT installs a word as the high level service routine in
9 INTERRUPT e.g. >INTERRUPT TEST, where TEST is the high
10 level service routine
11
12 VECTOR.INTERRUPT sets INTERRUPT.SERVICE up as the service
13 routine for the vector address on the stack
14
15
```

```
SCR # 259
0 VARIABLE CNTR @ CNTR ! VARIABLE INTERVAL @ INTERVAL !
1
2 HEX
3
4 @FF12 VECTOR.INTERRUPT
5
6 : INITCTC 027 18 PC! 069 18 PC! 0C7 19 PC! 05D 19 PC! ;
7
8 : KILLCTC 003 18 PC! 003 19 PC! ;
9
10 DECIMAL
11
12 : TEST ( - ) CNTR @ INTERVAL @ =
13     IF 1 CNTR ! 7 EMIT ELSE 1 CNTR +! THEN ;
14
15 >INTERRUPT TEST
```

```
SCR # 260
0 ( FORTH DIMENSIONS INTERRUPT HANDLER EXAMPLE COMMENTS )
1
2 @FF12 VECTOR.INTERRUPT sets INTERRUPT.SERVICE up as the service
3 routine for vector address @FF12
4
5 INITCTC sets CTC channels 0 and 1 up to do 1 sec. interrupts
6
7 KILLCTC stops the generation of CTC interrupts
8
9 TEST increments CNTR until it equals INTERVAL and then resets
10 it and emits a beep
11
12 >INTERRUPT TEST installs TEST as the high level service routine
13 in INTERRUPT, the high level interrupt word
14
15
```

# Serial Print Driver

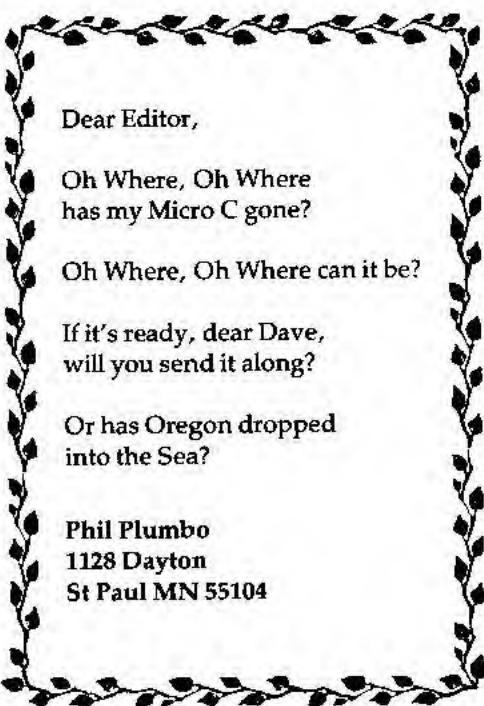
By David Thompson

The following is the much-requested general purpose serial printer driver for the BB I. It was written for the Crowe Assembler. Use your text editor to move the semi-colons around and change the baud rate and BIOS bytes to set it up for your system.

Then assemble it and you are on your way. Those of you writing software for others might look at the heading. This is the kind of information that I like to get with a new piece of source.

■ ■ ■

(Letters continued)



Dear Editor,

Oh Where, Oh Where  
has my Micro C gone?

Oh Where, Oh Where can it be?

If it's ready, dear Dave,  
will you send it along?

Or has Oregon dropped  
into the Sea?

Phil Plumbo  
1128 Dayton  
St Paul MN 55104

Editor's note:

OK Phil, we were late with issue #8 (and we'll be late again with this issue). But since you're so well versed, I feel I have to reply. Though there is no rhyme nor reason for it.

There once was a journal so witty,  
that it didn't belong in the city,  
so it packed up its kit,  
moved even the wit,  
but it's still late, which is surely a pity.

(Letters continued on page 20)

```
PRINTER DRIVER
WRITTEN BY DAVID THOMPSON
11/12/82
WRITTEN FOR THE CROWE Z80 ASSEMBLER

COMMAND LINES TO ASSEMBLE: CROWE PRINT.Z80
LOAD PRINT

JUMPER JB4 (CHANNEL A) OR JB5 (CHANNEL B) AS FOLLOWS:
7-8, 11-12, 15-16, 19-20, 23-24, 27-28

Suggested wiring for the printer cable:
Big Board - printer (usually)
1 - 1 ground
2 - 3 transmit data (from Big Board)
4 - 6 request to send (RTS) (from Big Board)
5 - 20 clear to send (CTS) (from printer)*
6 - 7 data set ready (DSR) (tied high on the BB)

* CTS can be whatever line the printer raises when it is ready to
receive characters.

You only have to use the RTS or DSR lines if your printer requires
a high level input from the computer before it will acknowledge
by raising CTS.

ORG 100H

; (UNCOMMENT THE PORT YOU WANT AND COMMENT OUT THE OTHER WITH ";")
; **** PORT A ADDRESSES *****
; DATA EQU 04H ; PORT A DATA ADDRESS
; STATUS EQU 06H ; PORT A STATUS ADDRESS
; BAUDGN EQU 00H ; ADDRESS OF PORT A BAUD RATE GEN.

; **** PORT B ADDRESSES *****
; DATA EQU 05H ; PORT B DATA ADDRESS
; STATUS EQU 07H ; PORT B STATUS ADDRESS
; BAUDGN EQU 0CH ; ADDRESS OF PORT B BAUD RATE GEN.

; **** EDIT THE FOLLOWING TWO EQUATES FOR YOUR OWN SYSTEM ****
; | also edit the SIO INITIALIZATION TABLE to |
; | select the proper bits/char and parity |
; BAUD EQU 0EH
; 05H = 300 BAUD
; 06H = 600 BAUD
; 07H = 1200 BAUD
; 0AH = 2400 BAUD
; 0CH = 4800 BAUD
; 0EH = 9600 BAUD
; OFH = 19200 BAUD
; JMPTABL EQU 0E80CH ; USE E80C WITH DRC CONFIGURED CP/M
; USE EAOC IF YOU USED DRC BIOS
; WITH YOUR OWN COPY OF CP/M
; WORKPLA EQU 0EF20H ; THIS IS WHERE THE PRINT ROUTINE
; AND THE A REGISTER PATCH
; WILL RESIDE (ABOVE PFM)

; BOOT EQU 0 ; RETURN TO CP/M
; RDY EQU 10H ; IS THE SIO READY FOR ANOTHER CHAR?
; INITCNT EQU 09H ; LENGTH OF INITIALIZATION TABLE

; **** INITIALIZE THE PORT *****
; INIT LD A,BAUD ; SET BAUD RATE GENERATOR
; OUT (BAUDGN),A
; INITA LD HL,INITBYT ; POINT TO FIRST CONFIG BYTE
; LD C,INITCNT ; MOVE RIGHT NUMBER OF BYTES
; INITB LD A,(HL)
; OUT (STATUS),A ; INITIALIZE SIO FROM INITBYT TABLE
; INC HL
; DEC C
; JR NZ,INITB

;
```

# Talking Serially

By David Thompson

```
MOVA LD HL,JMPA ; MODIFY THE CBIOS JUMPTABLE
LD DE,JMPTABL
LD BC,0009H ; MOVE 9H BYTES
LDIB

; MOVE LD HL,JMPB ; MOVE THE PRINT ROUTINE INTO
LD DE,WORKPLA ; HIGH MEMORY
LD BC,25H ; MOVE 25H BYTES
LDIR
JP BOOT ; NOW WE'RE ALL DONE INITIALIZING

; **** THIS OVERLAYS THE BIOS JUMPTABLE AT CONOUT, LSTOUT, AND PUNOUT.

JMPA JP WORKPLA ; 6 BYTE PATCH - RETURNS CHAR. IN A
JP WORKPLA+06H ; SERIAL OUTPUT ROUTINE (LST:)
JP WORKPLA+06H ; SERIAL OUTPUT ROUTINE (PUN:)

; **** THIS IS THE 6 BYTE PATCH WHICH MAKES SURE ANY CHARACTER SENT ****
; TO THE CONSOLE IS RETURNED IN THE A REGISTER

JMPB LD A,C ; SEND THE CHARACTER TO PFM
CALL OFOOCH ; UNLESS THE A REGISTER
LD A,C ; GO SCREAMING BACK
RET

; ***** THIS IS THE ROUTINE IN HIGH MEMORY WHICH CHECKS THE STATUS OF *****
; THE SIO AND SENDS IT CHARACTERS WHEN IT IS READY

OUTCHAR LD A,RDY ; RESET THE SIO SO WE CAN SEE IF
OUT (STATUS),A ; IT IS READY
IN A,(STATUS)
AND 20H ; IF BIT 5 IS NOT SET THEN LOOP
JR Z,OUTCHAR
SIOX IN A,(STATUS)
AND 04H ; IF BIT 2 IS NOT SET THEN LOOP
JR Z,SIOX
LD A,C ; BITS ARE SET SO OUTPUT CHAR TO SIO
OUT (DATA),A ; RETURN TO CP/M
RET

; ***** TABLE TO INITIALIZE THE SIO *****
INITBYT DEFB 18H ; RESET SIO
DEFB 01H ; SELECT REGISTER 1
DEFB 00H ; NO INTERRUPTS
DEFB 04H ; SELECT REGISTER 4

; -- select one for register 4 --
DEFB 45H ; 16X CLOCK, 1 STOP, ODD PARITY
DEFB 44H ; 16X CLOCK, 1 STOP, NO PARITY
DEFB 47H ; 16X CLOCK, 1 STOP, EVEN PARITY

; DEFB 03H ; SELECT REGISTER 3 (RECEIVE DATA)

; -- select one for receive register 3 --
DEFB 0E1H ; 8 BITS/CHAR, AUTO ENABLE, RECEIVE
DEFB 61H ; 7 BITS/CHAR, AUTO ENABLE, RECEIVE

; DEFB 05H ; SELECT REGISTER 5 (TRANSMIT DATA)

; -- select one for transmit register 5 --
DEFB 0EAH ; DTR, 8 BITS/CHAR, ENABLE XMIT, RTS
DEFB 0AAH ; DTR, 7 BITS/CHAR, ENABLE XMIT, RTS

; END
```

END

If you need to make two computers communicate with each other via RS-232, then chances are the following tactics should make them talk.

You need two male RS-232 connectors and some cable with 7 or more conductors.

pin	pin
1 ground	1 ground
2 Xmit data	3 Receive data
3 Receive data	2 Xmit data
4 Request to send	5 Clear to send
5 Clear to send	4 Request to send
7 Signal ground	7 Signal ground
8 Data Carrier Detect	8 Data Carrier Detect

You will need to pull pin 8 high so both ends know that the interface is active. The easy way to do this is to jumper pin 6 (data set ready, DSR) to pin 8 on the Big Board end. You'll notice on both the BB I and II that DSR is tied high through a resistor.

Both systems must think they are terminals (DTE). Each is expecting to see a modem (DCE) on the other end. This is why lines 2-3, and 4-5 are swapped between the two connectors.

On the BB I, jumper pins 7-8, 11-12, 15-16, 19-20, 23-24, 27-28 on either JB4 for channel A or JB5 for channel B.

On the new BB II, jumper pins 3-4, 7-8, 11-12, 15-16, 19-20, 23-24 on JB1 for channel A or JB3 for channel B.

Now Modem7, YAM, or even PIP can transfer data either way.



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# Pascal/Z

## Review by Rex Buddenberg

1910 Ash St  
North Bend, OR 97459

I chose Pascal/Z a couple years ago to run on my system. This article explains some of my reasons for choosing Pascal as a language, and Pascal/Z as the compiler.

I was not able to compare different compilers and had essentially only the sales literature and some reviews to work on. The things that attracted me to that particular compiler was that it was a native code compiler; that is, finished programs are .COM files that run directly from CP/M. (By way of reference, JRT Pascal requires a run time executive.)

Pascal/Z was also reputed to be a "fast" compiler; what that means is that finished programs run quickly. Compilation time is fairly slow partly because it accesses the disk a lot.

### Why Pascal

Why did I choose a Pascal compiler? My original system is a North Star (my Big Board has only been up and running a couple months now) and it came with a fairly decent BASIC interpreter.

However programs became very cumbersome once they got a little complex. All variables were global and the limitation on variable names didn't help me keep track of what each variable did.

Pascal seemed to offer the modularity that I felt I needed in programs—build one segment to access the file, say; then use the same code any number of times in any number of programs.

Pascal also offered several logical devices that BASIC didn't such as WHILE-DO and REPEAT-UNTIL constructs. I also felt that the structured approach required by Pascal was what I needed to keep discipline in my programs. It all sounds good, doesn't it? Has Pascal been the answer to my needs? Well . . . partially.

### Which Pascal?

I had been watching Pascal ever since UCSD released a version that was supposed to run on 8080 micros. I tried tinkering with UCSD Pascal and gave up the operating system as a bad job—between North Star I/O routines and my Hazeltine terminal, the screen editor just wouldn't work. Then UCSD rewrote the licensing agreements and the price went up. Time to scout the competition.

Pascal/Z looked good, but at a price. The code executes quickly, but the compiler takes a while to get from source to finished .COM program. The biggest asset that I discovered as my programming progressed was the package's ability to compile modules separately.

### Separate Compilation

Separate compilation is a feature of the implementation, not the language. First a main module must be prepared. That module must contain all global variable declarations and the main program block. Each procedure and function called by the main program must either be in the main module or must be declared as an external. Externals can then be put into up to 15 CPM files.

A print routine, for instance, can be quickly modified and relinked without recompiling the whole program.

### Problems

The compiler, assembler, and linker generate numerous files among them gobbling up disk space in a hurry (very much unlike the old BASIC interpreter) and makes compilations slow.

You can alter a few lines of code in a BASIC program and check the result im-

mediately; not so with Pascal.

It is a compiler rather than an interpreter. That means that translating the code to machine language so you can try it will take longer even though the resulting code will run faster. Second, you must be prepared for a bit more tinkering before you get something to run—a couple of long nights are usually on order. As a result, there is less impulsive changing and more planning to Pascal programming than BASIC.

Most Pascals designed for 8-bit machines limit the maximum integer to 32,767 which is sometimes a problem for accounting software.

Another pitfall is input and output processing. Pascal was defined when magnetic tape was the basic means of mass storage, so only sequential file access is defined in the standard. However, everyone writing software wants random access and all Pascal compilers support it. All differently. This greatly limits program portability.

Pascal/Z doesn't recognize the CP/M end of file character so you have to make sure you write a dummy EOF into your program.

*(continued on next page)*

## BUYING A BIG BOARD? READ THIS FIRST!

Let me put it together for you. I am experienced at electronics assembly and am set up to produce finished and tested Big Boards you can be proud of. If yours arrives with any defective parts, I'll test it and find the problem. Negotiating for spares is between you and Digital Research.

Normal assembly time is about two weeks. Total charge is \$100 or \$60 if you have already bought the kit with the sockets installed. Include \$5 extra for return postage. Idaho residents add \$3 sales tax. I also repair botched Big Boards for a price to be determined upon inspection.

Send your kit (or have Digital Research send it) to:

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Moscow, Idaho 83843

If you have any questions or wish references as to the quality of my work, call (208) 885-7093 weekdays; evenings call (208) 883-0847.

ASK ABOUT PRICES FOR COMPLETE SYSTEMS

# LETTERS

Dear Editor,

Enclosed is all the "complete" documentation on the ROMAC SculTek single board computer. They have a full page ad in each Computer Shopper.

It is a straightforward Z80 64K system and in January 1982 it seemed to me like a better deal than the Big Board. ROMAC sells a terminal board (supposedly emulates the Z19), PROM programmer, speech board, and controller board. I bought both the computer and terminal boards.

However, I am now disappointed by the lack of documentation, the refusal of the manufacturer to answer my letters, and misleading advertising. The manufacturer did not mention that the firmware (code in ROM) was only available on disk (that part that was available

(Pascal Z continued)

A final hassle for me is related to my needs. Database systems presented the most practical uses for computers to me (in close competition with word processing). Pascal can be used to build pretty powerful database systems. The problem is when you need to add a field to each record ... you must redefine so much of the program that it is not a modification—it is major surgery and no one has designed a database program generator to create Pascal code.

## Conclusion

Lest things sound dismal, I found Pascal much more to my liking than BASIC. I have joined the Pascal/Z User Group primarily because I learn most of my programming by seeing how somebody else solved a problem, then adapting his program. Like the Micro Cornucopia bunch that I met at Portland in June, this is a personable group.

Pascal programs are much easier to read than their BASIC counterparts. It is far easier to remember what you programmed 6 months ago, or read and understand what someone else programmed. For me, this is well worth the price of the compiler.



at all). Also, the buyer has to have another CP/M machine to bring up the system or has to shell out another \$99 for a "starter kit." I plan to dig through the code and find enough info to make a memory map so I can program a memory-mapping ROM.

Victor

*Editor's note:*

*Victor is still trying to get SculTek's attention so he can complete his system and he did not ask that I publicize his plight. But I felt that this information was important enough to other computer builders that I have taken the liberty of running this letter without his full name and address. The SculTek manual is hardly worth the paper it was xeroxed on. If it were the scribbled notes from the designer's notebook, then they had a very amateur designer. Tektronix expects its engineers to maintain substantially better documentation on the first pass at a new design. The best of luck, Victor.*

Dear Editor,

I built the EPROM programmer in issue #6 for 2716s and 2732s. I found that some 2716s need to have pin 21 tied to +5V to work reliably during read and verify. To do this I changed SW2 to a double-pole-double-throw switch. One side is used just as it was in the original schematic to switch programming voltage for the 2732. The other side is wired to switch pin 21 of the 2716 between the programming voltage and +5V.

Dennis Juve

2935 6th St

Marion, Iowa 53202

Dear Editor,

Your recommendation for removing rosin from printed circuit boards is greatly appreciated. I have recently come upon several problems in boards built by novices, and the problems were caused by rosin residues. We have high humidity and salty air, so rosin contamination can result in anything from occasional glitches to complete failure.

I use alcohol like you do but I use a cheap paint brush along with plastic foam containers (from supermarkets) to catch the drippings.

Be careful about breathing alcohol fumes. Though they are not as toxic as some solvents, they are both dangerous to health and a fire hazard. Good ventilation is a must.

I have Shugart 901 drives all over the

place. I got them all "as is" and have repaired them as I've needed them. I run them at the 6ms step rate with no problems. They are very reliable and the only errors I've experienced are the CP/M comments when I forget to reboot.

Just received JRT Pascal—isn't it beautiful! Also have C80. Now if I can just become ever so slightly adept ... what fun.

Jim Buckler

325 Rita Boulevard  
Melbourne Beach, FL 32951

Dear Editor,

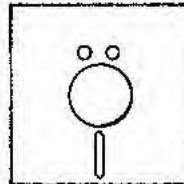
You made some goofs editing my article on the MFE drives (See the MFE Interface article in issue #8). In the third paragraph, "location 215" should be "location Z15" and the -15V should read -12V.

The fourth paragraph should indicate that the drives with only a single LED will read only double-sided disks (you edited it to indicate they would read only single-sided). This means that the user has to punch the standard double-sided index holes on all his disk envelopes. See below.

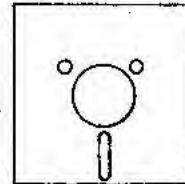
Also, I forgot to include the double-sided option jumpering for the drives. These alterations are not well described in the MFE manuals. To set up drive 0 as sides A and C; cut HS1, Jumper HS2 and DS1, and solder a wire from AS2 to DS3 (the pins next to the numbers). To set up drive 1 as sides B and D; jumper HS2, DS2, and AS4. DS stands for disk select, AS stands for alternate select.

Rick Gerson  
Ontario Cancer Institute  
500 Sherbourne St

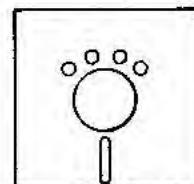
Toronto, Ontario, Canada M4X 1K9



single-sided floppy  
(normal)



double-sided floppy  
(normal)



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(continued on next page)

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<sup>1</sup>Price drop from \$169.95 to \$127.50 good through January 31, 1983.

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<sup>2</sup>Characters are blocks: 2 wide by 3 high in an 8 x 10 dot matrix, for a total of 11,520 addressable points.

<sup>3</sup>Similar to TRS-80 commands.

<sup>4</sup>Switch not included.

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(Letters continued)

Dear Editor,

I have a model 771 George Risk Industries keyboard. Not all the keys respond as I would expect, some not at all. Also, I would like to protect my system from voltage surges. Any ideas?

Finally, I would like to send you some articles. Is WordStar OK? Do you send back the disk? How do I pack it?

Keith Von Borstel  
4481 Slodusty Rd  
Garden Valley, CA 95633

Editor's note:

I don't know anything about your keyboard but if you put a 100 ohm resistor and an LED in series — then hook the combination between each keyboard output pin and ground you will see what the output is for each key (for all the keys that are encoded). Then you can write a translate routine for the BB to change the output to what you want.

Get a MOV (metal oxide varistor) from GE for surge protection. They look like disk ceramic capacitors but they knock line spikes down to almost nothing. The larger MOVs handle bigger spikes.

Wordstar is just fine. I have a little routine that takes the garbage out of WordStar files

(from user disk #3). I send the disk back if you ask for it, (and I put your choice of user disk on it besides). Most folks send an extra disk upon which I put the free user disk so that I can keep the original submission in my files (muchly appreciated). But either way is fine.

Put the disk in a small box (thick enough that it won't fold). Then write on it "MAGNETIC DISK DO NOT FOLD." Even then the post office manages to fold about 10 percent of them. However, the small, thin-cardboard "disk mailers" get folded over half the time. Anyone who says postpersons are lazy has never seen what they can do to a package.

Dear Editor,

I am in the U.S. Air Force and am stationed in Germany. On February 12 I ordered a Big Board from DRC, some hardware from Jade, and a subscription to Micro C from you (by the way, Micro C is probably the best users group newsletter I've ever had the pleasure to subscribe to).

By March 15, I had received my Micro C and a letter from Jade saying that the \$1200 I had sent was insufficient.

On May 1, I called Jade (cost 5 cents per second) only to have them tell me

that I didn't exist. \$1200 is a lot of money to misplace.

On May 15, I received my keyboard and video modulator from Jade but still no drives (and I was planning to use the power supply from the drives to power the BB).

On June 1, I called Jade and they told me that the drives had been shipped 2 weeks before by first class mail. That meant that they should have already arrived.

On June 15, I called Jade again. The customer rep was very courteous (after putting me on hold for \$20) and told me I didn't exist. He told me he would look into my problem and drop me a letter if he found out something.

Finally, a note to frighten the stout hearted souls who are still following along. If Jade ships my drives in one box (rather than in two as I asked) the weight will be 8 lbs. over the air mail maximum. Does the phrase "a slow boat to China" mean anything to you?

Anyway, if I ever get my BB up and running I promise to write and tell everyone how my system turned out.

SRA David B Burgess  
Box 5921  
APO NY 09012

# C'ing Clearly

Column by Tony Ozrelic

L.A. Software  
6708 Melrose  
Los Angeles, Ca 90038

Just a few beginning notes. It appears that the Code Works is shipping version 2.0 of their Q/C C compiler. It comes with an all-new 138-page manual which is even better than the original, and the compiler has been improved too. For instance, in conjunction with Microsoft's M80 assembler, it generates smaller programs since the linker can select only those routines needed from the runtime library. See the New Products section for more information.

For those of you looking for reading material on C, I recommend (of course) *The C Programming Language* by Kernighan & Ritchie, and *The C Puzzle Book* by Feuer. The first book is the definitive reference for the language, the latter explores different ways to write C programs. We'll have a review of it shortly. Both of these can be ordered from Opamp Books here in L.A. Their number is 213-464-4322. They ship quickly and take Visa and MC.

## Filters

A filter, in the programming sense, does pretty much the same thing it does in hardware: it accepts or rejects certain things (in this case certain information).

Suppose, for instance, that you want to display all the control characters in a text file on your printer. To do this you would want to convert all the characters whose ASCII values are less than a space or greater than a tilde to some visible combination of characters that the printer could print. That program might look like:

```
main()
{
    char c;

    while((c=getchar()) != EOF) {
        if(c < ' ') {
            putchar('~');
            putchar(c+64);
        }
        else if(c > '^') {
            putchar('~');
            putchar('^');
            putchar(c-64);
        }
        else putchar(c);
    }
}
```

You will need to define EOF and this depends on the character your compiler generates when it detects end of file. It also needs a name so let's call it CONV.C and after compilation we can run it like:

A>conv <text.dat>lst:

Text.dat gets searched, character by character, for characters outside the normal printing range. If it finds a line feed, for instance, it would be converted to the printable characters ^J. A character with the value 129 would be converted to a ^A. By simply changing the tests in the WHILE loop, we can filter out and convert stuff till we run out of ideas. For instance, you could convert WordStar files to straight text, uppercase to lowercase,

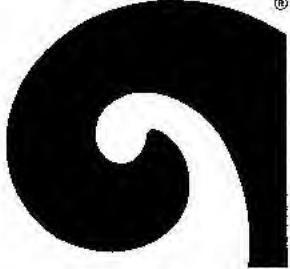
formfeeds to linefeeds, tabs to spaces, assembly listings to assembler source, 8080 opcodes to Z80 opcodes, and so on.

Of course, the conversion of 8080 to Z80 would be a little more involved but the overall structure would be the same:

char line[80];

```
while(gets(line) != EOF) {
    if(is8080(line)) {
        convz80(line);
        puts(line);
    }
    else puts(line);
}
```

■ ■ ■



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Nov. 15, 1982

# Bringing Up WordStar

By Gordon Banks, M.D.

Probably the most popular word processing program for CP/M is WordStar. It is easy to use, has extensive "help" menus, and allows the document to be edited and formatted using the same program. It is not as powerful as MINCE (a CP/M version of the powerful editor EMACS, which currently only runs on mainframes), but it suffices for most needs and is easier to use for documents. The WordStar installation program contains prompts to allow installation with just about any hardware.

While in a few moments you can bring WordStar up on the Big Board if you have the CP/M LST: device installed, the ideal companion for WordStar is a proportional spacing printer such as the Diablo. Since the standard CP/M LST: device has output, but no input, it is better to install the printer using built-in port drivers which reside in WordStar, and use the ETX/ACK communications protocol. This allows the most efficient use of the relatively small (256 byte) buffer of most daisy-wheel printers.

First run the install program and select ADM3a from the menu. From the printer menu, select your printer, in my case, the Diablo 1620. From the protocol menu, I chose the ETX/ACK protocol, as this is implemented on the Diablo.

I selected port drivers from the next menu. The Big Board ports are, of course, direct i/o (not memory-mapped). WordStar then asks if you want the install program to try to find your ports or accept them from you. The port configuration of the Big Board is such that WordStar cannot find your ports properly, so you must specify them. The port addresses for SIO port A (B) are:

output	04	(05)
output status	06	(07)
ready bit	04	(04)
mask	04	(04)
input	04	(05)
input status	06	(07)
ready bit	01	(01)
mask	01	(01)

The installation program will ask for these bytes (in hex) in order given here and they should be entered as given for your port. You will then be asked if your

1360 Scaife Hall  
University of Pittsburgh  
Pittsburgh, PA 15261

installation is complete. The answer should be no, as there are a few more very useful patches that you can make. When you answer this question no (N) you are asked to give the locations you wish to change. Refer to your WordStar documentation for the exact locations, as the locations I give here refer to version 3.0 and your version may differ.

First, WordStar has an initialization area into which you can patch a routine to initialize your serial port. If you do not do this inside WordStar, it will be necessary to run a separate program to do this prior to running WordStar. At the location INISUB: (2A4 in version 3) patch a jump to the large blank area MORPAT: at 2E0, (code: C3 E0 02). Then at MORPAT: patch in the initialization routine (actually, it may be easier to do this using DDT after you have finished installing WordStar):

```
2E0  MVI  A,07 ;1200 baud character
2E2  OUT  0C ;send to baud rate
              generator
2E4  MVI  A,04 ;select sio register #4
2E6  OUT  07 ;sio chan B control port
2E8  MVI  A,44 ;16 x clock, 1 stop bit, no
              parity
2EA  OUT  07
2EC  MVI  A,03 ;select register #3
2EE  OUT  07
2F0  MVI  A,C1 ;8 bits transmit character
2F2  OUT  07
2F4  MVI  A,05 ;select register #5
2F6  OUT  07
2F8  MVI  A,EA ;8 bits receive character
2FA  OUT  07
2FC  RET
```

If you want another baud rate, don't forget to change the 07h in location 2E1 to the appropriate character (see the BB documentation).

The Big-Board has one feature that the ADM3a does not that will speed up WordStar: clear-to-end-of-line. Patch this character (^X=18H) into location 26E, after putting a 1 into 26D to indicate only one character is necessary for this function.

WordStar has several built-in delays following cursor positioning and other functions. This allows slow terminals to keep up without losing characters. I found them to be unnecessary with my Big Board so I set them to zero. They are located at DELCUS: (2AE) and DELMIS: (2AF). There are other delays at DEL1: to DEL5: which control the waiting for various menus that you may wish to alter to suit your own taste. ■ ■ ■

## BACK ISSUES

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1/2 PFM.PRN  
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### ISSUE NO. 2 (10/81)

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Shugart Jumpers  
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### ISSUE NO. 9 (12/82)

BB II EPROM Program  
Relocating Your CP/M  
Serial Print Driver  
Big Board Fixes  
Bringing Up Wordstar  
Cheap RAM Disk  
32 pages

\$3.00 each  
(US, Can, Mex)      \$5.00 each  
(Other Foreign)

# A Cheap RAM Disk For the BB I

By Tony Ozrelic

LA Software  
6708 Melrose  
Los Angeles, CA 90038  
213-932-0817

Faced with ever lengthening compile time and an insatiable need for speed (my BB already runs at 5MHz), I've designed a 256K RAM board plus the software to make it appear to be a single density drive.

I've seen assembly time for 11K of source reduced from 30 seconds to 7 seconds and compilation time for a 18K C source has been reduced from 5 minutes 20 seconds to 3 minutes 26 seconds.

Generally I've noticed that programs that access the disk a lot show the most improvement (which would include editors like Mince and Wordstar).

## How It Works

The RAM disk (which I call Dynadisk), is connected to the BB via the user PIO at J5. After booting up CP/M, you execute DYNA.COM which patches the disk I/O calls (in the monitor), initializes the PIO, and relocates itself to F800, just above the PFM monitor.

The program (all 200 bytes of it) monitors the disk I/O calls looking for references to drive D. Accesses to drive D are translated into accesses to the RAM board.

## Additional Software

SWAP.COM swaps drive A and drive

D so Dynadisk becomes drive A and the real disk drive "A" becomes drive D.

DCOPY.COM will copy all of real drive A to drive D (Dynadisk). It takes about 45 seconds to copy 241K. And, of course, you can reverse the process and copy the Dynadisk onto a real disk in 45 seconds. (Editor's note: are you single-drive folks listening?)

DFORMAT.COM formats the Dynadisk to look like the disk format.

## Theory of Operation

In the block diagram, Dynadisk's main section is 256K bytes of memory. The next section contains the address registers which appear to CP/M as track and sector registers. For the sake of efficiency, I set it up as 8 tracks, with 256 sectors per track. Each sector contains 128 bytes. This means that the Dynadisk contains  $8 \times 256 \times 128$  or 262,144 bytes (two to the 18th power). I use software mapping to make my RAM disk look like the real thing.

Transfers are initiated by selecting a track (0-7) and sending that byte to the track register, then selecting a sector (0-255) and sending that byte to the sector register (the status of PB0 indicates which register is being primed).

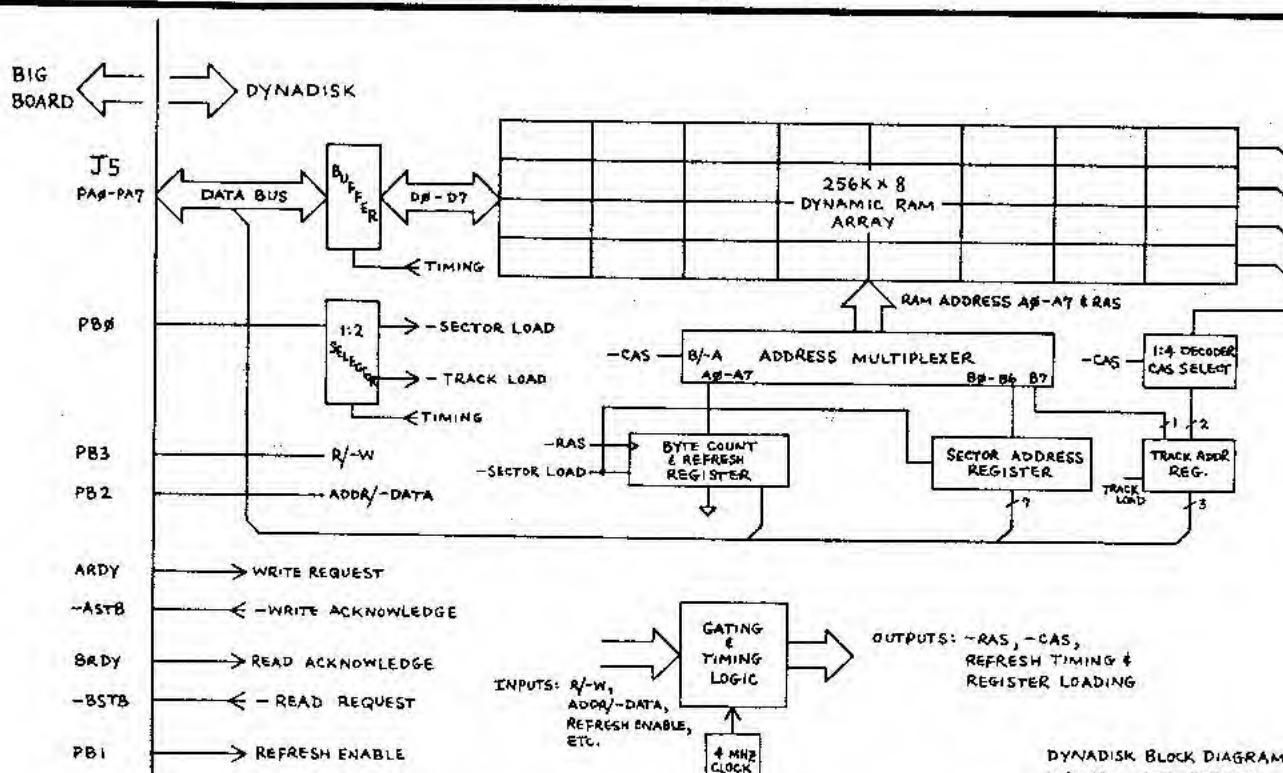
Then you drive PB1 low to turn off refresh and initiate the 128-byte transfer. Each time a byte is transferred, the byte-count/refresh register is incremented. Immediately after the 128 bytes have been transferred, PB1 is brought high to turn on refresh again and Dyna waits for the next data transfer.

I have a detailed theory of operation along with complete schematics, parts list, and software listings, but the whole package would more than fill a whole issue of Micro C. So, I will provide all the above plus a disk of software for \$25. By January I hope to have a PC board available for an additional \$40.

At that time I plan to have a complete kit available for \$375. The complete package will include the board, software, parts, sockets, cables, and documentation; everything you need to put it together. Be sure to write or call to verify availability before ordering the bare board or complete kit.

Editor's note: I'm sure you all know the prices of the commercial RAM disks, so my main worry is that Tony will be overwhelmed by orders. Such a problem.

■ ■ ■



DYNADISK BLOCK DIAGRAM  
10/26/81 A.J. OZRELIC



We noticed that the 5V output was 5.07V (on my newly calibrated Fluke) but when we jumpered the remote 5V sense terminal to the 5V output terminal the output came down solidly to 5.00V and stayed there. Period.

It was very apparent by the time we'd finished our digging that when Teletype builds a power supply it really builds a power supply. This switcher is super duty all the way through. It even has 3 LEDs, one tied to each output voltage. If one of the voltages is not present, its LED isn't lit.

#### I/O, I/O, It's Off to Work We Go

I have been hearing some really outlandish things about what happens to a system when you add a bunch of RAM and tell the system that the new addition is a disk. (Thus proving you can fool some of the systems all of the time.) Suddenly, I/O isn't a dirty word.

I've heard of 7-hour compiles finishing in 20 minutes, and short compiles reduced to the time it takes to type the command line and hit the carriage return. I've even heard that Mince and Word Star get so fast and so quiet (disk accesses are somewhat quieter when it's a RAM disk) that users think they are running single-user on a DEC 11-70.

So what. Who's got a RAM disk for the Big Board? Well, Semidisk says it is working on a Big Board version. Semidisk's 512-byte board which lists for \$1995 would plug into the Z80 socket.

Plus, Tony Ozrelic is running his own 256K version designed to interface with the BB via the parallel port. Check out the article describing it this issue.

#### New Phone number

Despite strong suggestions to the contrary (e.g. "How do you get any time to yourself?" or "Have you considered psychiatric help for your compulsion to answer the phone?"), we will continue to list our phone number in the magazine. The only people who threaten that policy are those East Coasters who forget that 7:30 am their time is 4:30 am here. Since it's not unusual for me to work until 1 or 2 in the morning, I'm not in much of a mood to help someone interface a new hi-rez dahoozit to a drive latch when I've had only a couple hours sleep.

In fact, at that time in the morning I'm usually lucky to find the phone at all, much less find it before it wakes up the whole family. So here it is: 503-382-8048. (And try to call between 1 pm and 6 pm Pacific time; that way I have evenings to get something done.)

#### Software Wanted

Jennifer, our 8-year-old, would very much like to learn to touch-type so she can help Sandy and I with Micro C and also so she can use the text editor on her school work. I remember what I went through in typing class so I'm looking for something better, such as a well-thought-out typing training program (preferably public domain).

In fact, I would guess that many of you have little people who would love to learn typing and programming and so forth on your BB. So, keep your eyes peeled for anything appropriate to short sorts. Maybe we'll put together user disk #1/2.

#### Disk

This issue contains the disk article that I didn't have room to run in issue #8. Sandy read through the article and decided she didn't like it because it didn't come to very many good solid conclusions about which brands of disks you should buy and which you should avoid.

Outside of the obvious winner—Dyson—and the obvious losers—Maxell, Wabash, and possibly 3M—what you purchase is pretty much up to you. Variations from one batch to the next appear to make it nearly impossible to rank the rest of the brands (how's that for a conclusion).

Overall, it appears that disks are getting better, especially in terms of media life. After all, Elephant is guaranteeing that its disks will never forget and they are simply rebranding Wabash product, the shortest-lived brand on the market. I'm trying to find a good source of disks other than the 3Ms I'm now using (too many errors). Hopefully I can tie down some BASFs.

#### A Narrow View of Drives

Shugart has just announced half-wide 8" drives, the single-sided 810 and the double-sided 860. They feature fast-

start; beltless, DC drive motors and no head-load solenoids.

It sounds very much like Shugart has just announced the latest Tandon drive. They are supposed to be absolutely compatible with the 801 and 851 right down to the mounting holes. However, because the drives shut themselves down you are probably doing to have to change your BIOS so CP/M remembers not to try to read for a few milliseconds after selecting a drive.

The effect on the drive market should be most interesting. (Already I've seen brand new, Shugart compatible, Siemens drives for about \$250 each.)

First, as competition increases the prices of the half-wides should be coming down. After all, they are smaller and simpler to manufacture.

Second, as more and more people select the half-wides, prices of the standards should drop even more substantially. This price drop should be especially noticeable in the used and surplus markets. I expect the prices for used and surplus 800s, 801s, and compatible drives to hit \$100 in the next year.

In some cases you can now find them for \$150 to \$175. However, these are usually special one or two unit deals.

If you know of a really good deal in 8" drives (under \$200 new or in new condition) where they have enough units to make it worthwhile to announce it to the group, (and you can vouch for their integrity) please let me know. There are still a lot of Micro C readers who are un-driven or under-driven because they can't afford \$400 per drive.

#### And Finally

Merry Christmas and have a Happy New Year. May all your bugs be small ones and may all your employers and clients be generous. Ho, Ho, Ho!



David Thompson  
Editor & Publisher

# On Your Own

By David Thompson

In the first two installments of this column we discussed some of the business of working for others. However, many consultants are simply high-paid, short-term employees.

I started out working for others in this mode but with Micro C I'm definitely doing my own business. I like this much better.

You've no doubt been wondering what kind of business you could start that would generate some very real income and get you totally away from employeeshood. Of course, your mother can tell you that the possibilities in this field are endless (and she probably has). The problem is that you haven't connected with the endless possibility that will work for you.

So let's see if we can't connect you with something workable.

## Great Big Connections

There are BIG connections that you can make by writing a new compiler, interpreter, screen editor, data base language, spread sheet handler, etc. However, this is such a visible and competitive field that you need something special to crack it now.

That doesn't mean you can't do it, but it helps a lot to have a combination of right-place/right-time, and a little genius. This also requires a tie-in with a good marketing outfit or a lot of time, moxy, and money to get it off the ground by yourself.

The marketplace is changing very rapidly, which is both a disadvantage and an advantage. Change can be a disadvantage because the market could well disappear while you are writing the code (or the life of your product could be very short). Change can be a great advantage if you predict the market correctly and have the right product ready at the right time. Then your only financial problems will be with the IRS.

For instance, if you guessed correctly that the 68000 processor was going to be the next big winner (IBM is reportedly working on another system that may completely replace their PC), and you guessed correctly which operating system they would use, you'd be someone we'd all admit knowing. However, IBM insiders already have this information

and are already preparing to take advantage of it.

IBM is selling 10,000 PC's a month so it doesn't take advanced math to figure out what some folks are making off IBM compatible software and hardware.

## Medium Size Connections

There are smaller connections that include selling hardware or software by mail order. Billy Gage (BG Micro) is probably not lying awake nights wondering where the next dollar is coming from. He knows because he is offering a lot of products, good service and some very good prices.

ICI is doing quite well selling software. Their overhead is low enough that they can make good money on margins that would strangle larger outfits.

This area has its own special set of problems (like waiting weeks or months for the software packages to ship to anxious purchasers). We'll discuss some of the problems of mail order at a future date.

## Tiny Connections

The smallest connections can actually be the most worthwhile and dependable. These are the one-to-one connections between you and the end user.

For instance, the end user might need a way to handle his mailing list and keep his books.

Even large software houses are now specializing in custom systems for small businesses. These outfits will combine a Z80 or 8086 based hard disk system with a custom data base handler and rake in \$50,000 to \$500,000 for the package.

Then they put the user on a contract for hardware and software maintenance. The contract usually covers service on the hardware and guarantees that the user will pay \$50 per hour for any software modifications. It turns out that software maintenance usually winds up costing the user several times as much as the initial package price over the life of the system. Even if the software is absolutely perfect when delivered, changing user needs usually dictate continuing updates so this is usually a long-term relationship (and income).

The Big Boards (both I and II) now have the hard disk interfaces that are

necessary for handling large data bases (or large compiles or large anything else that used to mean large, expensive computers). So you now have inside access to one of the best bargains in computing power in the industry.

If you use a Big Board you can build a spare system, complete with drives, for what you would charge for a 6-month service contract. If your client's system goes down, just swap. Then you can repair the defective system at your leisure or have someone else work on it.

Meanwhile, as business grows and you get busy writing data base handlers or whatever, you are going to need other folks who will put together anything from assembled and tested boards to complete hard disk systems. (Do you hardware types smell a market?)

Finally, if you keep ownership of the software, then it's very possible you will find a larger market (medium size connection) among people in the same business. So you advertise in Micro C or wherever to sell your software to other computer folks interested in selling complete packages (with your software) in their area.

And, of course, it doesn't take very many \$20,000+ systems (or \$500 a month service contracts) to keep bacon on the table (and eggs and frozen waffles ...).

## WANT ADS

The following folks are reaching you for only 20 cents per word. If you would like to reach the same audience, send your words and 20 cents for each to Micro Cornucopia.

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\$500 with documentation  
Harry Siegmund  
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## USER'S DISK #1

Over 200K of software especially for the Big Board.

### Including:

- 1-Two fast disk copiers.
- 2-The manual for Small C+.
- 3-A Z80 assembler.
- 4-Two disk formatters.
- 5-Othello.
- 6-A serial print routine.
- 7-Modem software.

## USER'S DISK #5

This disk is a potpourri of significant software collected from the far reaches of the globe by world-renowned software hunters.

### Including:

**1-CAT** is a directory cataloging package. It keeps track of which disk contains which software. It sets up a file and lets you list the directories of all your disks, or display all the disks that contain a particular file, or all the disks that contain .TXT (or whatever) files, plus much more. You've got to try it to believe it! Contributed by Don Bell from a Pascal-Z user disk.

**2-MODEM7A.COM & MODEM7B.COM**: Already configured for BB ports A and B by Gary Kaufman.

**3-PACMAN**: Gordon Banks and Gary Kaufman both sent me PACMAN.C and .COM. This really works like the commercial game. (Caution, don't even whisper a word about this to kids over 3 or you'll have to stand in line to use you BB.)

**4-FAST**: This little screamer from Gordon doubles the speed of any program that accesses the disk a lot (like ASM, MAC etc.).

**5-NOLOCK**: NOP's out the shift lock feature on the BB so you can send nulls to other systems without casing your own (from Gordon again).

**6-VERIFY**: Brett Berg sent in this one. It checks a disk and tries to restore bad sectors. It reports any sectors it is trying to restore. It leaves the data intact (or even more intact) on the disk. Brett says this is better than the \$100 commercial routines.

**7-SQ-USQ** squeeze and unsqueeze files.

## USER'S DISK #2

Especially for folks with single-drive systems and those who want to try their hand at extending an assembler. Also a new CBIOS with parallel printer interface. Returns to default drive on reboot, stifles head banging, supports CP/M 2.2 and 1.4. Step by step instructions for the simple incorporation into your CP/M.

### Including:

- 1-Two single-disk copy programs, both with source.
- 2-The source of the Crowe Assembler.
- 3-New Crowe.com file with larger symbol table.
- 4-New CBIOS for CP/M 1.4 and 2.2 (& boot).
- 5-Disk mapper with source.

## USER'S DISK #6

This disk contains one of the more significant new contributions to the public domain. The runtime package for 8080 has 51 functions to handle all those details that take so long to write.

### Including:

**1-RUNPAC**: This is the run-time utility package written by Dennis Baker for his 8080 assembly language programs. Even though it occupies only 1,951 bytes in memory, this utility package handles 51 functions including: 4-byte addition, subtraction, multiplication, and division; string evaluation; number formatting; opening a file; closing a file; getting a record; keyboard input; chaining and running a .COM file; finding a string in a group; and converting days to date.

It handles up to 8 channels of disk I/O, each having a 512 byte buffer and a file control block in high memory. Runpac uses signed integer binary arithmetic with provisions for decimal I/O. This gives maximum numeric range for 4-byte variables. This package should handle any business or other application that does not absolutely require floating point. Includes source which assembles under ASM.

**2-REZ**: This is the Z80 version of the famous disassembler RESOURCE. Originally from the CP/Mug, it disassembles 8080 and Z80 object files. It was contributed by Gary Kaufman.

All Users Disks ..... \$15.00 each (US, Can, Mex) ..... \$20.00 each (other foreign)  
All The Users Disks Contain Documentation On Disk In .DOC Files.

## OTHER GOODIES

US, CAN, MEX Other Foreign

**FORTH IN ROM** ..... \$65.00 \$70.00  
in fast ROM ..... \$80.00 \$85.00

This is standard FIG FORTH in three 2716's. FIG FORTH is standalone FORTH so you don't use CP/M at all. If you have disks, FIG FORTH handles the disk I/O. If not, you can still enjoy a most fascinating language. A simple FORTH line editor and a decompiler are available on disk.

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This two-ROM set takes control of the system just like FORTH does, handling its own I/O, loading Basic programs and object code routines on and off the disk or out of the third ROM. This little Basic is great for controller and utility applications.

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This is the best, most complete collection of "working for yourself" information I've found (and I've heard nothing but good comments from those who have received it). This two-volume set is a perfect for those blustery fall evenings when you snuggle up in front of the fire and dream of great riches.

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- 1-Two fast disk copiers.
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- 3-Two disk formatters.
- 4-Othello.
- 5-A serial print routine.
- 6-Modem software.

**USER'S DISK #2**

- 1-Two single-disk copy programs, both with source.
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- 3-New Crowe.com file with larger symbol table.
- 4-New CBIOS for CP/M 1.4 and 2.2 (& boot).
- 5-Disk mapper with source.

**USER'S DISK #3**

- 1-ROM programmer software.
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- 1-CAT, disk cataloging routines.
- 2-MODEM7A-MODEM7B, Modem7 for ports A and B
- 3-PACMAN, play the most popular arcade game at home.
- 4-FAST, buffers the disk to speed up assemblies, etc.
- 5-NOLOCK, get rid of PFM upper/lower case switch.
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- 3-REZ, 8080/Z80 disassembler

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- Reverse Video Cursor

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- EPROM Programmer
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- Adding 6K of RAM
- Viewing 50 Hz
- Technical Tips

**ISSUE #8 (10/82)**

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- Flippy Floppies
- Interfacing Drives
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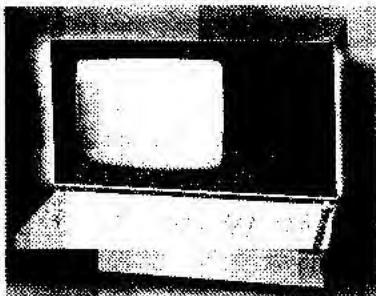
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## UNIVERSAL ENCLOSURE



12" Green Ball Brothers monitor with enclosure measuring 19" x 16.5" x 14". Room inside to mount a Ferguson single board computer or small SS-50/S-100 system. (Power supply available, see below.) Requires +15 volts DC. @ 1.5 amps, noncomposite (separate sync) input. A sync separator schematic is available. It is also possible to mount a single 8" disk drive or two of the new slim line 8" disk drives in this enclosure. All units are used, and have been 100% tested.

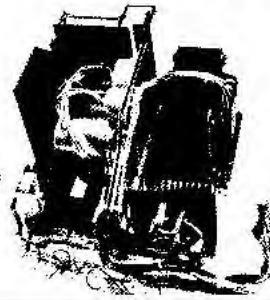
Shipping weight 35# ..... \$65.00

ASCII Keyboard (used) with enclosure to match above monitor. 77 keys, 7 lighted pushbuttons, on/off sw. Requires 5 volts DC. Schematic included. Includes shift, tab, control and cursor control keys. Size: 19 x 4 x 5½.

Shipping weight 8# ..... \$35.00

Modular power supply (missing regulator card) fits inside above monitor enclosure. Includes large transformer that outputs +8.5 volts @ 17 amps, +/-18 volts @ 1.5 amps each, +15 volts @ 1.5 amps (for monitor), three large capacitors (1-18kuf, 2-8kuf), 1-30 amp, 2-3 amp bridge rectifiers. The transformer and rectifiers/capacitors make a perfect unregulated SS-50/S-100 power supply. The schematic for the regulator card is available.

Shipping weight 25# ..... \$25.00



## D & W ASSOCIATES

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The Single Board Systems Journal

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